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Effect of women-centric community-based programme on intra-household decision making in Agriculture

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Abstract:

We used treatment effect models to assess the effect of the women-centric community-based programme on intra-household decision making in agriculture. Using the data collected from an intra-household survey of 815 targeted and non-targeted households of a programme, we assessed the impact of women membership in a Self Help Group on dynamics of 14 farm and household related decisions by the primary decision maker and SHG member in the household. The study shows that though the role of women in decision making increased (8-10%), the effects vary according to the level of intervention and type of decision. Our results show that unlike micro-finance based SHGs, the conflicts were lesser in seed SHGs. Our study concludes that engagement of women in agriculture-based interventions could encourage joint decision making. Our finding suggests that development agencies engaged in interventions targeted to empower women should engage them in enterprising activities.

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1. Introduction

Sustainable Development Goal 5 of UNDP seek to achieve gender equality and empowerment for all women and girls. Several efforts in this regard has been initiated since early 1960s. Since then the concept of equality and empowerment had evolved from human rights to access and control over resources. The focus on gender in agriculture similarly evolved during the same period. International organizations such as United Nations, World Bank and CGIAR bodies started several gender centric initiatives (Sarapura-Esocobar et al., 2017). Following these efforts several programmes in agriculture are promoted by Government and Non-Government Organizations (NGOs) aiming at empowering women in agriculture in developing countries. Most of these initiatives targeted women in the households by providing them training on advanced agricultural technologies. Subsequently the approach has evolved from individual level (van den Bold et al., 2015; Quisumbing et al., 2015) to community level through layering them over existing community level programmes (Quisumbing and Kumar, 2011). The ultimate aim is to empower women in agriculture so as to achieve welfare of women and the household. There is a vast and growing literature on impact of such intervention on women empowerment (Rao, 2008; Quisumbing et al., 2015). Most of these studies have shown positive impact of participation of women in such interventions. Whereas, few studies have also reported opposite results (Garipitika, 2008; Balasubramanian 2013).

Women 'empowerment' is a broader concept and defined differently depending on the context. In general sense, empowerment essentially aims for achieving equal rights, capacity, access to assets and resources, and decision making authority (Alkire et al., 2013). Women Empowerment in Agriculture Index (WEAI) developed by Alkire et al (2013) has outlined various dimensions of empowerment; decision making, ownership, control, leadership and time. There are many dimensions of empowerment and intra-household bargaining power is

one of them (refer detailed reviews by Kedebe et al., 2014; Doss, 2013; Malapit and Quisumbing, 2014). Bargaining power within household is an important indicator of women empowerment and its impact on household welfare has been studied in various social and economic contexts across various countries. For example, in India, relative authority of women over their husband is associated with increased use of modern contraception (Jejeebhoy, 2002). Similarly, relationship between authority of women in decision making and nutritional outcomes has been studied in countries like Nepal (Malpit et al., 2013), Bangladesh (Bhagowalia et al., 2012), Ghana (Malapit et al., 2014).

Growing number of evidences in literature demonstrate lack of attention to intra-household dynamics in intervention targeted for women could significantly impact the outcome of interventions (see Alkire et al. 2013). Quisumbing and Kumar (2011) in their study had shown that interventions targeting individual women could result in growing gender asset inequality in household compared to targeting through groups. Anderson et al (2017) in his study had concluded that absence of spouse agreement could be challenge for interventions aimed at reducing gender inequality or empowerment of women in rural regions. Garipitika (2008) in her study on loan lent through SHGs in India has also highlighted that lack of women's co-ownership in productive asset could result in disempowerment. Thus it is important for studies on women empowerment programs to also focus on intra-household dynamics as it is one of the potential constraint for bringing the desired impact. In this context, the present paper explores the impact of women centric community based programmes on intra-household decision-making. We have studied the intra-household differences in perceived decision-making authority on set of decisions relating to farm and household.

In this paper, Self-help group (SHG) based initiative is studied in a typically patriarchal society in Uttar Pradesh, India. We conducted a preliminary survey (pilot) to understand the premises of problem and streamline the research. Focus Group Discussions (FGD's) and in-depth interviews were conducted to understand the impact of SHG interventions on women empowerment. During the survey we came across many anecdotal evidences of changing intra-household decision making in targeted households. Many stories were shared on the household and community conflicts faced during their journey as a member of SHG. The important takeaway from the narrative is that the financial support obtained through SHG's played an important role in bringing the change in intra-household dynamics. Interestingly, one of the major intervention of SHG was to train members on seed production technology. The insights from the pilot study hinted that such intervention could have a great impact on intra-household bargaining power and decision making as agriculture is mainly dominated by men in the study area. It prompted us to look into the household bargaining power in the context of household decision making authority.

Our study contributes to the existing literature on intra-household decision making in following ways. The existing empirical work on intra-household dynamics and decision-making is largely restricted to single spouse account on decision making. Few intra-household studies done so far looked into interaction between husband and wife using a dual household model (Anderson et al 2017). However, in developing countries households have multiple

adults and decision makers may not be household head and spouse (Doss 2013). In this line, we go away with the 'a priori' assumption that only husband and wife takes decision in the household. We opened up the option and considered primary decision maker and the spouse for the study. We also explored the nature of outcome of the interactions, which is mainly limited to the physiological studies.

2. The Intervention:

Strengthening *Informal Seed Systems through Women Self-Help Groups in Uttar Pradesh, India* is a programme funded by Bill and Melinda Gates Foundation (BMGF). The seed production programme was layered on the existing Self-Help Group SHG initiatives of Rajiv Gandhi Mahila Vikas Pariyojana (RGMVP), Rae Bareli, Uttar Pradesh, India. The programme was first carried out in a pre-pilot phase in 2014 in two districts (Amethi and Rae Bareli) covering six blocks across the districts. The programme was launched later (2015) as full fledged project with one year of baseline and pilot phase, and scale up phase in five districts (Amethi, Lucknow, Pratapgarh, and Rae Bareli and Sultanpur) covering 12 blocks in these districts in Uttar Pradesh, India (Figure 1).

[Insert Figure 1]

The programme leverages the existing women SHG platform to strengthen informal seed systems in order to address issues around seed availability, access and utilization to ensure seed security, women's empowerment, and nutrition security. This envisaged to be achieved by strengthening the existing seed delivery system and creating new sources of seed supply. The existing seed delivery systems include public seed sources for certain varieties, farmer to farmer exchange, farmers saving her own seed, and informal market mechanisms. New sources of seed supply include linkages with universities and research institutes (for both foundation and certified seed of existing and new varieties), SHG seed producers and the others. The production and dissemination of farmer preferred varieties through SHGs was conceptualized to enable women farmers to access these seed. The seed production programme was integrated to the existing SHG initiatives. Members of selected SHGs households become seed producers and procured seed. The twin objective of the project was to strengthen informal seed systems (access to seed) leveraging the existing SHGs and to empower women in agriculture. Details regarding the model and functioning is given in Subash and Srinivas (2018).

In two ways this community programme is ideal to address our research question. One, this programme is implemented in a patriarchal society in a developing country. Uttar Pradesh state in India is characterized by a patriarchal society with households and farm decision authority traditionally be held by male members of the family. The programme focuses on providing training and demonstration to women members of the households in seed variety selection, production and other agricultural related activities which is dominated by male in this region. Secondly, the seed production programme is layered over an existing micro-finance programme run as self-help group. This provide as an opportunity to distinguish the effect of by intervention types; only micro-finance, and seed and micro-finance.

3. Theoretical framework

The earlier studies in women's intra-household authority were modelled on a unitary household framework (Bobonis, 2009; Qusumbing and Maluccio, 2003). These models assumed that spouse's preference are homogenous (Anderson et al., 2017) and the bargaining power with the household does not affect the outcome (Doss 2013). An extensive literature is available now which challenges the unitary models (Duflo and Udry, 2004, Lundberg et al 1997; Balasubramnian, 2013). But studies had also argued that unitary model holds good in specific situations (Doss 2013). The recent theories on intra-household bargaining are broadly divided into three; co-operative, collective and non-cooperative bargaining models (Doss, 2013). These models "offer an alternative characterization of intra-household decision making process" (Anderson et al., 2017). Co-operative model assumes that the bargaining outcome in a household is a result of direct negotiation between the spouses and their relative power. Collective models assume that households could achieve Pareto efficiency and one could be better outcome without making another worse off (Doss 2013). Non-co-operative models hypothesize independent action of the spouses leading to a self-enforcing Nash equilibrium which may or may not be Pareto efficient (Lundberg and Pollack 1994). Studies in developing countries have reported existence of non-co-operative bargaining models (Mabsout and Van Starveren, 2010; Malapit and Quisumbing, 2014). These models have shown the potential effect of women's decision making power on welfare of the households (Kebede et al., 2013; Malapit and Quisumbing, 2014).

Another theory which define the nature of the outcome in decision making (decision making power) is interpersonal circumplex model (Freedman et al., 1951). Interpersonal circumplex model classifies the personality traits into agreeableness, quarrelsomeness, dominance and submissiveness. Our study more specifically draws from the dyadic conflict outcomes of dominance and submissiveness (Wheaton, 1974; Au and Lam, 2015).

4. Methodology

Sampling Method

The study is based on intra-household primary data collected from sampled SHG and non-SHG households in the pilot study region (5 districts with 12 blocks). Multi stage random sampling was employed. At stage one, Targeted and Non-Targeted Village Organizations (VOs) (situated at *Gram Panchayat level*) were randomly chosen from 12 blocks. The number of VOs and the number of sampling households were determined based on power calculation¹. A census was done for SHG members in the sampled VOs to check whether the

¹ The sample size was estimated through power calculation using optimal design software (Spybrook et al., 2011). The effect size was calculated based on paper by Garikipati (2008) which also looked on impact of SHG women lending on women empowerment. The estimated effect size ranged from 0.12 to 0.24 for various household level decisions. We used effective size approach in estimating the number of VOs and power size approach in estimating total sample size. A total of 92 VOs were sampled (with effect size 0.12 and $\alpha=0.05$). For estimation of total sample size per VOs we considered higher effect size (0.20) with $\alpha=0.05$. The sample size was estimated to be 800 and we interviewed 840 households

SHG and SHG member exists. At stage two, from the sampled VOs (targeted and Non-targeted) the population was divided into six strata; seed producers in targeted SHG in targeted VO (S1), non-seed producers in targeted SHG in targeted VO (S2), non-seed producer SHG in targeted VO (S3), non-SHG members in targeted VO (S4), non-seed producer SHG in non-targeted VOs (S5) and non-SHG members in non-targeted VOs (S6) (see Subash and Srinivas 2018 for further details). The SHG households was randomly sampled from the census data on targeted households in the region. In each stratum a total of 140 households were sampled. A total of 840 households were planned to be surveyed however we ended up surveying 815 households. The non-SHG households in targeted and non-targeted VOs was randomly selected from households after doing census of non-SHG households in the sampled VOs in treatment and control region.

Data

The study relies on primary data collected during the period June to July, 2017 using three set of structured questionnaires. One for the household (interview with the household head), other for the women SHG member (separately if the household head is not SHG member) and another for the primary decision maker in the household (Spouse or other family member- if SHG women is not the primary decision maker). In case of non-SHG household interview was done with the household head, primary decision maker (If household head is not the primary decision maker in agriculture) and spouse of the household head.

[Insert table 1]

The interviews of SHG members and primary decision makers (if the SHG member is primary decision maker, there won't be separate interviews) was done separately. This approach is different from the conventional approach of interviewing husband and wife in a dual household model. As Doss (2013) has pointed out, in rural areas of developing countries, there might be multiple adults and decision makers may not be household head and spouse. So we have designed the study in a way that we do not implicitly or explicitly assume the household head and spouse as primary decision makers. Rather, we have analysed the primary decision maker and his wife (for non-SHG households) and primary decision maker and women SHG member (For SHG household). The primary decision maker in agriculture is determined by information provided by the household head. Data was collected on the socio-economic characterizes, decision making (production, marketing, postharvest harvest practices, access and control of resources), social capital, time and resource allocation, farm characteristics and cost of cultivation would be collected.

5. Empirical model

In the first step we have, estimated the effect of SHG membership (Seed/ Non seed) in improving the role of women in agricultural decision making using unitary household model. We modelled gender of the primary decision maker as stated by household as a function of

(140 households per strata). We oversampled it by 5% to account for missing observations / possible data collection errors.

group to a gamete of individual, household and farm characteristics. The empirical form of the model is

$$P(X=1/0) = \beta_0 + \beta_1 G_k + \beta_2 X_{ij} + \beta_3 Y_{ij} + \beta_4 Z_{ij} + \mu$$

where, X is the primary decision maker and X=1 indicates female and 0 otherwise. G_k is the group (seed SHG, non-seed SHG and others) to which the household belongs and X_{ij} is a set of individual characteristics, Y_{ij} set of household characteristics and Z_{ij} is a set of farm characteristics.

To analyze, the intra-household difference we model it as

$$P(H=1/0) = \beta_0 + \beta_1 G_k + \beta_2 X_{ij} + \beta_3 Y_{ij} + \beta_4 H_{ij} + \beta_5 Z_{ij} + \mu$$

Where, H is the household and H=1 indicates conflict household and 0 otherwise. G_k is the group (Seed SHG, Non-seed SHG and others) to which the household belongs and X_{ij} is a set of individual characteristics primary decision maker, Y_{ij} set of individual characteristics of individual 2, household characteristics and Z_{ij} is a set of farm characteristics.

One of the pre-requisite for reliable Impact assessment is that the treated and the control are similar. This can happen only if all the households have same probability of being member of a SHG. However, such random ness in program allocation is an absolute rarity. The SHG households possibly be different from the non SHG households as households with certain characteristics have higher probability of being am member of SHG. Estimating impact without accounting for such differences lead to selection bias. One way of circumventing this problem is to use the treatment effect models which controls for the differences before estimating the impact. In our case as the ex-post study is done using a non-experimental approach, quasi impact assessment methodologies such as Propensity Score Matching (PSM) and Inverse Probability Weighted Adjusted Regression (IPWRA) are used. These models are used extensively in similar recent studies (Abebaw and Haile, 2013; Ainembabazi et al., 2017; Bernard et al .,2008, Wossen et al., 2017a, Wossen et al., 2017b).

Propensity Score Matching (PSM)

PSM is a commonly used methodology especially with cross sectional data. PSM approach estimates a propensity score based on which treated households are matched with untreated households and the difference in the outcome variables are measured as impact (Dehejia and Wahba, 2002). Propensity scores are estimated using a logit model. The average treatment effect can be estimated following (Imbens and Wooldridge, 2009)

$$ATT = E[Y(1) - Y(0)|T = 1]$$

where $Y(1)$ and $Y(0)$ are outcome variables for treatment and control households. PSM assumes that there is no systematic difference among the observed and un-observed characteristic among those households. This means that PSM could produce a biased result if the PSM model is mis-specified (Robins et al., 2007; Wooldrige, 2007; 2010). Though this is a major limitation in PSM, studies had shown that the un-observed characteristics which affect the participation could be independent of the outcome (Imbens, 2004). It assumes that the heterogeneity observed due to unobserved characteristics could be distributed equally

across the treated and non-treated (control) households. This assumption could be checked using Rosenbaum bound sensitivity analysis (Rosenbaum, 2002). Another way of addressing the issue is by using IPWRA approach.

Inverse Probability Weighted Adjusted Regression (IPWRA)

IPWRA is a combination of regression and propensity score methods. This could solve the issue of mis-specification of the model and bring robustness in estimation (Imbens and Wooldridge, 2009; 2010). The linear regression model could be expressed as

$$Y_i = \alpha_i + \beta_i x_i + \varepsilon_i$$

Where Y_i is the outcome variable, x_i 's are a set of control variable, α and β estimates, ε is the error term, and $i \in [0,1]$ for control and treatment. In case of IPWRA, first we estimate the propensity scores $[p(x_j, \hat{\gamma}^0)]$. In the second step, we estimate (α_0, β_0) and (α_1, β_1) employing linear regression estimation, using inverse probability-weighted least square as

$$\begin{aligned} \min_{\alpha_0 \varphi_0} \sum_i^N (Y_i - \alpha_0 - \varphi_0 x_i) / p(x, \hat{\gamma}) \text{ if } T_i = 0 \\ \min_{\alpha_1 \varphi_1} \sum_i^N (Y_i - \alpha_1 - \varphi_1 x_i) / p(x, \hat{\gamma}) \text{ if } T_i = 1 \end{aligned}$$

The Average Treatment Effect (ATT) is computed by taking difference between the two equations.

$$ATT = \frac{1}{N_w} \sum_i^{N_w} [(\hat{\alpha}_1 - \hat{\alpha}_0) - (\hat{\varphi}_1 - \hat{\varphi}_0) x_i]$$

Where $(\hat{\alpha}_1, \hat{\varphi}_1)$ and $(\hat{\alpha}_0, \hat{\varphi}_0)$ are estimated inverse probability estimates of treated and control households and N_w is total number of treated household.

Outcome indicators

The outcome variables used in the study measures the effect of the model rather than the impact of the program. For the estimation of the effect of seed and non-seed SHG in improving the role of women in agricultural decision using unitary household model we used a binary outcome variable. We asked the household head 'as who is the decision maker regarding agriculture in the household. We had taken the variable as 1 if the primary decision maker in the household is female (See table 2).

As discussed in the theoretical framework, the intra-household bargaining may not be captured by the unitary household models. So to test our hypothesis that women centric targeted intervention has an effect on the intra-household bargaining power, we asked two individuals (Primary decision maker and individual) from each households, their role in decision making. It is impossible to measure individuals bargaining power, as it is fundamentally unobservable (Doss, 2013). On the other hand, bargaining in the decision making can be measured using various approaches. Anderson et al (2017) used a 'bean game' to capture the intra-household accord (difference). Similarly, other studies have used

experimental games (Ashraf, 2009) to capture the bargaining power. We followed simple game theory approach to measure the bargaining power, as it results in dyadic conflict with each player unknown about others move. This was captured by asking whether they take decision solely, jointly (spouse) or the decision is taken by other member of the family as options, for different decisions. The options (D_i) were compared between the two individuals; primary decision maker $P_i (D_i)$ and individual 2 [$S_i(D_i)$] plotted as a matrix $P_i (D_i) \times S_i(D_i)$. A total of 16 combinations emerged out of options provided to them (Figure 2). The combinations indicate the interaction of roles or bargaining among individuals or intra-household difference over decision-making.

[Insert figure 2]

The households were classified as conflict and non-conflict households based on options provided by two individuals. 'Conflict' is not to be considered as a negative connotation, it simply measures difference in perception of the individuals in decision making. The classification is based on game theory, in which the outcome is 'difference in the individual perception'. If the options make up the combinations 2, 3, 5, 9 and 11, they are classified as non-conflict household as the interaction is a result of an individual with no role or both individuals engaged in joint decision. While the combinations 6, 7, 8, 10, 12, 14, 15 is a result of difference in perceived decision making authority. The classification is highlighted by red and green boxes in figure 10 for conflict and non-conflict households. The combinations 1,4,13 and 16 were dropped as one among the individuals had no role or other individuals in the households had role in decision making. Based in this classification we had taken created a binary outcome variable (Conflict) if there is a conflict in intra-household decision making (Table 2).

[Insert table 2]

As discussed before the seed SHG programme is layered over a micro-finance SHG programme. This would help us in understanding the varying level of effect by the level of intervention. We designed the sample and collected data to look into differential impact of varying level of intervention by altering the treatment and control strata's. This is done by using different strata as treatment and control households (See table 3).

[Insert table 3]

To understand the nature of the outcome, the combinations were further classified into eight categories based on the gender and relative bargaining of the two individuals (Table 4). These classification is based on interpersonal circumplex model (Freeman, 1951) and dyadic conflict (Au and Lam, 2015). We used a self-reported measure unlike the scales commonly used to measure dominance and submissiveness of the individual (Mehrabian and Hises, 1978). Such self-reported measures are also used in the literature (Sommerfeld and Bitton, 2015). One of the limitation of such a measurement is that it is subjected to various observable and unobservable factors. Observable factors are presence of spouse and other family members and gender of the enumerator. We had added a variable to control for the presence of other spouse and other family member. On the other had all our enumerators were female, it might have created a bias in our observations. Also other non-observable variables such as

emotions would have impact on the outcome variable (Harlie et al., 2009). We measured the relative bargaining power (dominant or submissive) based on the option provided by both individual. An individual is stated to be in dominant position if he claims to be the sole decision maker, while other individual states no role in that decision or considers as joint decision, or states other family member. An individual is stated to be in submissive position if he states no role in that decision while the other individual states joint decision making.

[Insert table 4]

Category 'A' are households in which male plays a dominant role in decision making, while in category 'B' households female have a dominant role. Category 'C' are households in which there is a joint decision making. In all three cases, there are no conflicts and the roles are defined. Households belonging to category D and E, male and female members may not have self-recognized their role but their counterpart stated they take decisions jointly. This shows that the member under-estimated their role. In case of category F and G, one individual (male or female) claimed his role, while other shared it as joint role or did not recognized the counterpart's role. Male and female members had equal claimed themselves to be sole decision maker in households falling in category H. Category I are households where the conflicts were not identified. These categories were grouped as conflict (Category D to H) and non-conflict (Category A to C) households for computational easiness. The summary results are shown in tables.

Controlling variables

Several empirical studies had modelled various factors which could affect the bargaining power. The position of the women in the family, sex, age, education and assets are key variables (Chattopadhyay and Duflo 2004, Duflo and Urdry 2004). On similar lines, we have taken variables capturing individual, household and farm level characteristics. A list of variables which are used as control variables is given in table 5.

[Insert table 5]

6. Results and Discussion

A summary of variables used in the study is given in the session (Table 6). The variables are tabulated by strata (refer methodology). Majority of the households belong to OBC category. The share of disadvantage groups (SC/ST) were higher among SHG households (both seed and non-seed). This is because the intervention is targeted towards socio-economically backward households. About 63% of the households are nuclear family but the share was higher among SHG households in treatment region. Though, the seed-member seed-SHG had higher share of joint family. But the average number of household members showed pattern in reverse direction to that of family type. The average members were higher in non-seed member SHG households, followed by seed SHG households, SHG households and non-SHG households. Households across different strata possessed mainly semi-pucca houses. SHG households have better housing than non-SHG group in treatment region. Seed producers of SHG households had better housing than the non-seed producers of the same group. The livestock asset holding of the households were calculated by converting different type of

households into Livestock Units (LSU)². Average LSU was higher among SHG households compared to non-SHG households in control region. While it was vice versa in treatment region. Seed producers of SHG households had higher LSU compared to non-seed producer seed-SHG households. The SHG households are well-off compared on non-SHG households in both agricultural and non-agricultural assets in target region and vice-versa in control region. The average value of agricultural assets was higher in seed producer of seed-SHG households compared to non-seed SHG in treatment region. While the average value of non-agricultural asset was higher in non-seed SHG compared to seed-SHG households. Higher share of migrant members was found in SHG households in treatment regions and vice versa in control region. The share was higher in seed-producer seed-SHG households compared to other households in treatment region. The average land holding and cultivated households were higher in seed households and non-SHG members in treatment regions.

[Insert table 6]

The effect of participation of households in the SHG and other groups on the intra-household decision making differences is assessed using PSM and IPWRA. Once propensity score is calculated using the selection equation, with specification derived based on theoretical expectation and literature review, balancing property and common support assumptions were tested. We started our estimation with probit models (Table A1) with the treatments coded as 1 (for each effects).

[Insert figure 3 to 8]

Most of the covariates in the model complies with the expected signs from the previous studies. The density plots below indicates the satiation of common support assumption (Figure 3 to 8). We also checked for and robustness using different matching. The impacts estimated using alternative estimators are given in Table A2. As seen in the table the matching results gave more or less similar results. For evaluating the reliability of the estimates, we computed Rosenbaum bounds (Becker and Caliendo, 2007) and reported in Table A3. The test is based on NN match (5 neighbors) as shown in Table A2. For most of the cases gamma value (1) is not significantly different from zero, we fail to reject the null hypothesis, i.e., unobserved heterogeneity associated with selection of treatment has significant effect on outcome (Following Ainembabazi et al., 2017). Though it was true for most cases for effect 6 it hidden bias has shown significant result. As discussed in the methodology we estimated ATT using IPWRA add robustness to the results.

² [http://ec.europa.eu/eurostat/statistics-explained/index.php/Glossary:Livestock_unit_\(LSU\)](http://ec.europa.eu/eurostat/statistics-explained/index.php/Glossary:Livestock_unit_(LSU))

Effect of varying level of intervention

The impact of seed and non-seed SHG in improving the role of women in agricultural decision making using unitary household model is shown in table. We report the nonparametric estimates of the average treatment effect on the treated (ATT), which indicates the mean impact of the treatment. The study shows that the impact, measured as percentage of female members as primary decision maker, was significantly higher in seed-SHG (12%) and SHG (8-10%) compared to their respective control groups. Indirect effect of the intervention on non-SHG members was also observed. The impact of seed and non-seed SHG in improving the role of women in agricultural decision making using unitary household model is shown in table 7. Overall SHGs has shown a roughly 9% impact.

[Insert table 7]

Effect on Intra-household decision making

The self-reported authority on different decisions were captured using 14 questions. The questions were framed as “whether you alone, or jointly (with spouse), or other family member, take decision on the particular subject (listed as 14 questions). The calculation of intra-households difference from these questions are given in the methodology. The individuals (primary decision maker and spouse/SHG member) were interviewed separately to ensure that they do not influence each other. The circumstances of violation of this condition is quantified and incorporated into the model to see its effect. As discussed in the methodology, the intra-household difference among households in different strata are shown in table 8. Comparing across strata, the conflicts were observed in decision regarding borrowing and lending of money, and money received from sale of seed. This two are the decisions influenced by the interventions. In treatment region, in general, seed-member seed-SHG households showed lesser conflicts in decision making than non-seed seed-SHG households. The only exception to the above said statement was borrowing of money. Comparing seed and non-seed member households among seed SHGs, the relative conflicts were high only in case of borrowing and lending of money. The non-seed seed-SHG households had higher conflicts in decision making on buying selling of land and other property, education and participation in other groups.

[Insert table 8]

In control region, the SHG member households showcased higher conflicts compared to non-SHG households. The exception was only in decision regarding borrowing and lending of money, money received from cash crop sales and use of income earned by female member of the household.

The overall effect of participation of households in the SHG on the intra-household decision making dynamics is assessed using PSM and IPWRA. We report the ATT, which is the average of conflicts (% households with conflicts) for 14 intra-household decisions (Table 9). Significant impact was only observed in effect 1(Direct impact of seed production³). The

³ Assessment was also done for other effects but not reported in this draft.

effects were significant for decision on planting/harvesting of cash crop/variety and seed crop, buying selling of land, participation in institutions, and money received from food and cash crop sales. The results show that the conflicts were lesser in seed-producer households compared to non-seed producer households in seed-SHG.

[Insert table 9]

Nature of conflicts

The nature of conflicts in the decision on planting/harvesting of cash crop/variety and seed crop, buying selling of land, participation in institutions, and money received from food and cash crop sales where significant impact was observed is given in table 7. With respect to decision on planting/harvesting of cash crop/variety, higher share of male dominance is observed in SHG households in treatment and control region and non-SHG households in control region. Female dominance on this decision was only observed in seed-member seed-SHG households. In this case, conflicts were found to be higher in control groups.

[Insert table 10]

The conflicts with respect to decision on planting/harvesting of crop for seed was found to be higher in treatment regions. Female dominant households were only found among seed-member seed-SHG households. Male dominance was found in all non-seed SHGs and control households. Borrowing and lending of money is a key decision, which might have influenced by the participation of members in SHG (which is a micro lending programme). The results show that conflict was higher in SHG households in target region. In control region, the share of conflicts was similar in both control region, but the nature of conflicts differed (See Figure A9). Such male dominance is noticed in earlier studies by Garipitika (2008) and Balasubramanian (2013) where money lent by SHG groups are utilized by the male members leading to lower empowerment.

In case of decision on participation in institutions and other groups, female dominant households were found in SHG households and all households in treatment region. The share of conflicts was also higher in SHG households. The conflicts in these households were mainly due to female dominance. In non-SHG households' conflicts were mainly due to male dominance. Non-SHG households and SHG households in control region showed households with male submissive nature.

The conflicts on decision regarding money received from sales of food crops is higher among SHG households in both treatment and control household. The SHG households also had higher share of conflicts as a result of female dominance compared to non-SHG households. Male submissive households were observed in non-seed member seed-SHG households and SHG households in both treatment and control region. None of the households were female dominant. The male dominant households were higher among SHG and non-SHG households in the control region.

Similarly, decision on money received from cash crop sale, had no female dominant households and male dominant households were predominant among SHG and non-SHG households in control region. The conflicts were higher in non-seed producer seed-SHG

households and the share of female dominance was also higher among these households. The conflicts in non-SHG households in control region due to male dominance, on the other hand both male dominance and female dominance.

Conclusion

Our study provides suggestive evidence that women centric programme with interventions with enterprising activities could bring co-operation in decision making. The study shows that the role of women in agricultural decision making in SHG households has improved. The role of women engaged in SHG in decision making increased by 8-10%. However, no such incremental improvement was observed by households' participation in seed-SHG. Though the results are robust for controls for un-observed characteristic, our results might be overestimated as it was stated by the household head. The study reveals that intra-household conflicts exist across different intervention groups, but the nature of conflicts changed across the groups. The conflicts in non-SHG was as a result of male dominance, while in SHG-households it was due to female dominance. There are change in dynamics as a result of household member participation in SHG, but the dynamics is more co-operative when they engage in agricultural activities. Lesser conflicts among seed producer in seed SHGs could be attributed to lesser dominance by both the gender. The specific intervention in the study trained women for seed production, which is an enterprising activity. Seed producer women members engaged in selection of variety and cultivation of seed. Our study concludes that engagement of women in agricultural based interventions could encourage joint decision making. Our finding suggest that development agencies engaged in interventions targeted to empower women should engage them in enterprising activities.

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Tables and Figures

Figure 1. Targeted area under the project in Uttar Pradesh

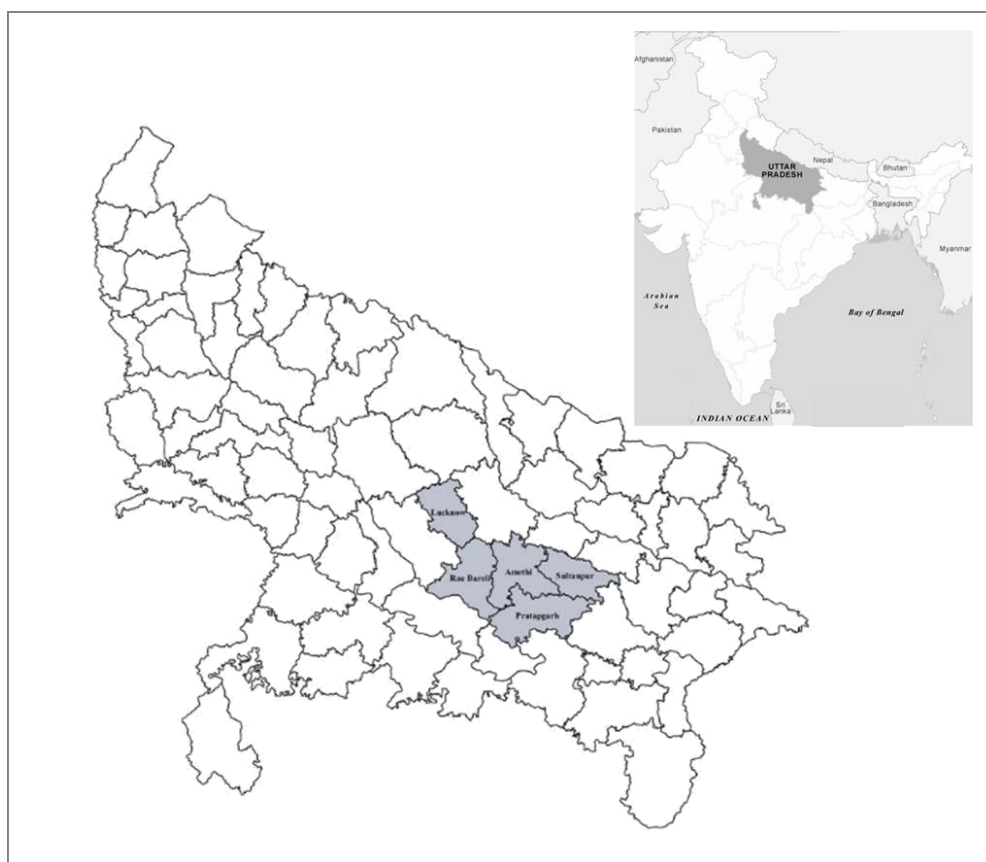


Table 1. Questionnaire-respondent classification

Questionnaire	Strata 1	Strata 2	Strata 3	Strata 4	Strata 5	Strata 6
Household	Household Head	Household Head	Household Head	Household Head	Household Head	Household Head
Individual 1	Primary decision maker	Primary decision maker	Primary decision maker	Primary decision maker	Primary decision maker	Primary decision maker
Individual 2	Seed producer women SHG member	Women SHG member	Women SHG member	Spouse of the primary decision maker	Women SHG member	Spouse of the primary decision maker

Note: If the primary decision maker is household head the Individual 1 question would be asked to the household head itself. If the Women SHG member is both Household Head and Primary Decision maker only one questionnaire would be administered.

Figure 2. Intra-household decision making matrix

		Individual 2			
		No role	Solely	Jointly	Others
Primary decision maker	No role	1	2	3	4
	Solely	5	6	7	8
	Jointly	9	10	11	12
	Others	13	14	15	16

Note: Individual 2 could be spouse of primary decision maker or SHG member (if SHG member is not primary decision maker in SHG household).

Table 2. Outcome variables

S.No.	Outcome variables	Type	Description
1	Primary decision maker	Binary	1= If primary decision maker is female, 0= otherwise
2	Conflict	Binary	1= If there is a conflict in intra-household decision making, 0= otherwise

Table 3. Framework used measure varying effect by level of intervention

	Treatment household	Control household	Assessment	Effect
1	Strata1	Strata2	Effect of seed production	Direct effect
2	Strata1 & Strata2	Strata3 & Strata 5	Effect of seed SHG	Direct effect
3	Strata 3	Strata 5	Effect of seed SHG and SHG	Direct effect
4	Strata 1 & Strata 2	Strata 5	Effect of seed SHG	Direct effect
5	Strata 5	Strata 6	Effect of SHG	Indirect effect
6	Strata 1,2,3,5	Strata 4,6	Overall Effect of SHG	Direct effect

Table 4. Categories of intra-household bargaining and as result of decision-making authority

Categories	Options	Description
A	2,5	No conflict but male dominant
B	2,5	No conflict but female dominant
C	11	No conflict joint decision making
D	3,9	Conflict male submissive
E	3,9	Conflict female submissive
F	7,8,10,14	Conflict male dominant
G	7,8,10,14	Conflict female dominant
H	6	Conflict equal claim
I	12,15	Conflict indecisive

Note: Combinations 1,4,13 and 16 were dropped

Table 5. Dependent variables

	Variable	Type	Description
1	Sex of the household head	Binary	1= If Household Head is Female, 0=otherwise
2	Age of the household head	Continuous	Age of the household head in years
3	Age square of the household head	Continuous	Square of the age of household head
4	Household head education	Binary	1= Household head is illiterate, 0= otherwise
5	Migrant	Binary	1= If spouse of the household head is a migrant, 0=otherwise
6	Caste	Binary	1= Higher caste, 0=otherwise
7	Family members	Continuous	Total number of members in the family
8	Agricultural asset	Continuous	Total value of agricultural asset
9	Non-Agricultural assets	Continuous	Total value of non-agricultural asset
10	Total land holding	Continuous	Total land owned by household (ha)
11	Cultivated land	Continuous	Total land cultivated by household (ha)

Table 6. Socio-Economic profile of the household

	Strata1	Strata2	Strata3	Strata4	Strata5	Strata6	Total
Caste							
General	9.09	11.67	10.69	10.29	12.88	21.74	12.70
OBC	47.40	50.00	51.91	50.00	53.03	52.90	50.80
ST	14.94	7.50	14.50	9.56	12.12	5.80	10.85
SC	28.57	30.83	22.90	30.15	21.97	19.57	25.65
Household type							
Nuclear	60.65	65.83	68.18	58.7	61.36	63.04	62.82
Joint	39.35	34.17	31.82	41.3	38.64	36.96	37.18
Household members*	5.74	5.93	5.86	5.60	5.55	5.69	5.72
House Type							
Kaccha	33.55	37.29	45.8	40.15	33.08	37.23	37.75
Semi Kuccha	43.23	44.92	32.06	41.61	49.23	40.88	41.96
Pucca	23.23	17.80	22.14	18.25	17.69	21.90	20.30
Livestock Units*	1.84	1.57	1.79	1.31	1.39	1.56	1.58
Agricultural Asset* value	14,714.	6,636.8	13,617.	9,680.9	10,056.	14,038.	11,626.
	48	1	65	28	64	65	34
Non-Agricultural Asset value*	21,734.	15,345.	29,194.	16,050.	16,031.	29,643.	21,454.
	36	27	6	27	63	10	97
Migrant	19.35	15.00	18.94	10.14	13.64	20.29	16.32
Land Owned (ha)	0.54	0.33	0.45	0.54	0.31	0.57	0.46
Land cultivated (ha)	0.54	0.37	0.44	0.51	0.33	0.57	0.46

*Note: Variables * are average values, others are in percentages*

Figure 3. Propensity score among treatment and control households for effect 1

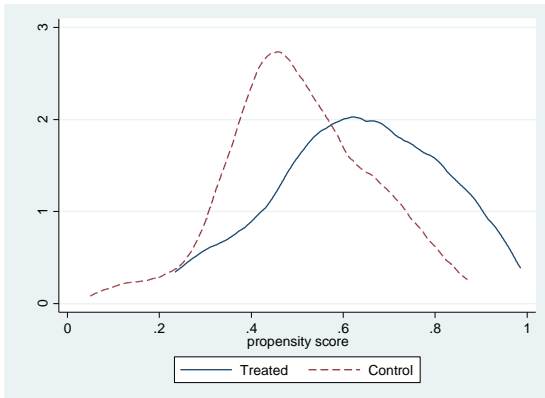


Figure 6. Propensity score among treatment and control households for effect 4

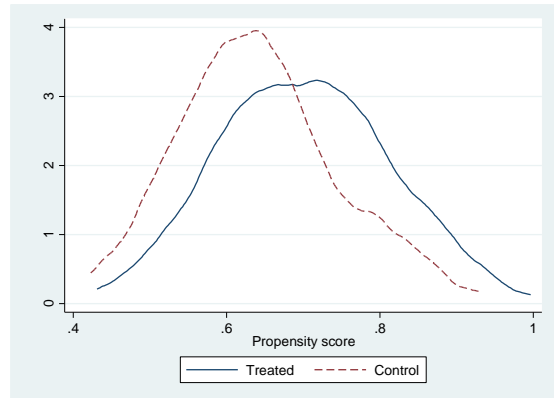


Figure 4. Propensity score among treatment and control households for effect 2

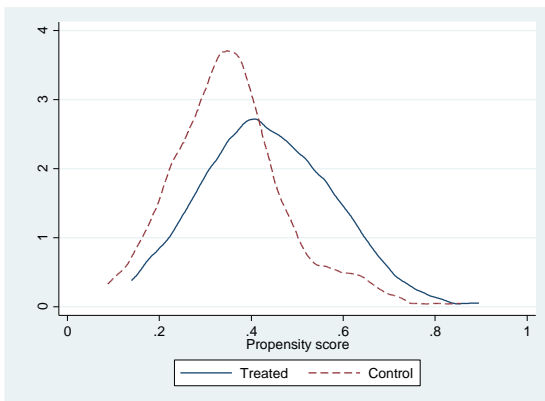


Figure 7. Propensity score among treatment and control households for effect 5

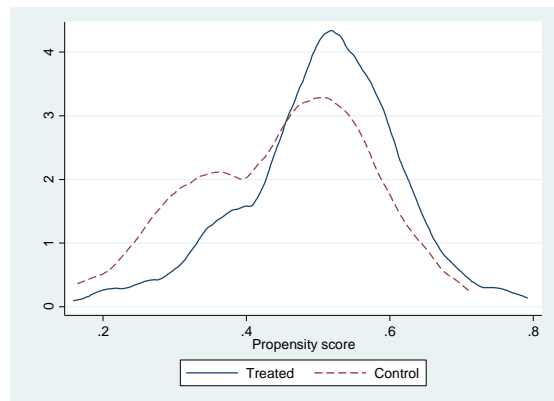


Figure 5. Propensity score among treatment and control households for effect 3

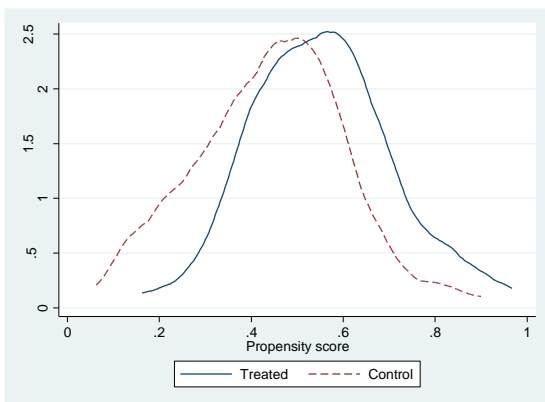


Figure 8. Propensity score among treatment and control households for effect 6

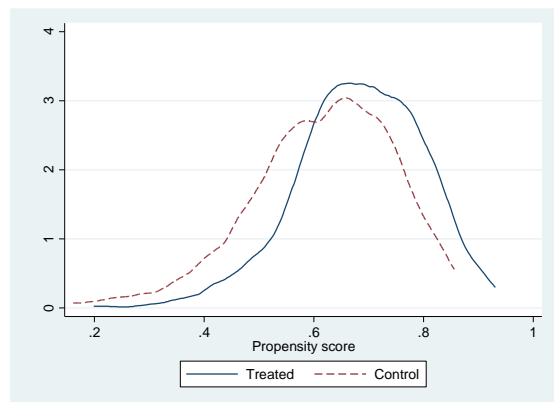


Table 7. Effect of intervention on improving role of women in agriculture.

Effect	PSM		IPWRA	
	ATT	P value	ATT	P value
1	0.05	0.277	0.04	0.530
2	0.06	0.326	0.08	0.100
3	0.07	0.187	0.08	0.222
4	0.08	0.136	0.12	0.020
5	0.13	0.007	0.11	0.018
6	0.10	0.004	0.08	0.025

Note: Balancing test and post-estimations were carried out (Appendix). P Value <0.05 is significant at 5% level and <0.01 is significance at 1%. In this table, we have reported ATT estimates with Nearest Neighborhood (NN) Matching with 5 neighbor. ATT estimated is obtained by applying 'nnmatch' command using the bias adjusted option in Stata (Abadie et al., 2004).

Table 8. Households which recorded conflicts in different decision making across strata (Percentage)

S.No.	Decisions	Treatment region				Control region	
		Strata1	Strata2	Strata3	Strata4	Strata5	Strata6
1	Planting /harvesting of food crop/variety	17.91	17.43	25.44	27.27	25.66	20.83
2	Planting /harvesting of cash crop/variety	14.17	22.33	22.94	26.96	21.50	15.74
3	Planting /harvesting of crop for seed crop/variety	18.11	21.15	19.05	22.52	21.70	15.89
4	Livestock keeping, buying and selling	16.00	21.36	18.37	21.55	22.22	21.62
5	Buying selling land and other property	13.71	23.00	18.18	17.27	24.07	22.22
6	Borrowing and lending money	23.62	23.58	19.05	19.30	24.77	26.13
7	Education and marriage of children	16.28	14.15	17.43	11.40	18.02	13.51
8	Participation in institutions and other groups	19.33	22.64	24.30	18.18	24.00	20.22
9	Money received from food crop sales	18.55	27.72	19.19	21.78	26.00	17.92
10	Money received from cash crop sales	17.54	25.00	18.09	20.21	19.78	21.21
11	Money received from sales of seed	20.34	20.62	17.58	19.15	18.89	18.18
12	Use of income the household in total earns from non-agricultural activities	21.49	20.59	15.15	25.47	23.81	20.75
13	Use of income earned by male household members	22.31	21.36	17.00	24.53	23.58	22.73
14	Use of income earned by female household members	20.17	21.36	16.00	25.96	15.31	22.64

Note: Strata 1= Seed member seed-SHG household in treatment region, Strata 2= Non-Seed member seed-SHG household in treatment region, Strata 3= Non-seed SHG households in treatment region, Strata 4= Non-SHG member households in treatment region, Strata 5= SHG household in control region, Strata 6=non-SHG member households in control region.

Table 9. Effect of participation of households in seed production on farm and household decisions

Decisions	PSM		IPWRA	
	ATT	P values	ATT	P values
1	-0.113	0.080	-0.054	0.385
2	-0.179	0.001	-0.170	0.016
3	-0.088	0.204	-0.117	0.091
4	-0.129	0.137	-0.108	0.130
5	-0.198	0.023	-0.164	0.019
6	-0.190	0.013	-0.152	0.054
7	-0.068	0.401	-0.064	0.358
8	-0.221	0.007	-0.206	0.011
9	-0.299	0.000	-0.277	0.000
10	-0.287	0.002	-0.242	0.003
11	-0.112	0.063	-0.135	0.076
12	-0.171	0.000	-0.139	0.079
13	-0.155	0.000	-0.130	0.101
14	-0.148	0.036	-0.152	0.052

Note: Balancing test and post-estimations were carried out (Appendix). P Value <0.05 is significant at 5% level and <0.01 is significance at 1%. In this table we reported Nearest Neighborhood (NN) Matching with 5 neighbor. ATT estimated is obtained by applying 'nnmatch' command using the bias adjusted option in Stata (Abadie et al., 2004).

Table 10. Nature of conflicts by farm and household decision

	Planting /harvesting of cash crop/variety						Planting /harvesting of crop for seed crop/variety					
	Strata1	Strata2	Strata3	Strata4	Strata5	Strata6	Strata1	Strata2	Strata3	Strata4	Strata5	Strata6
No conflict but male dominant	0.00	1.02	1.89	0.00	7.92	2.00	0.00	1.01	1.92	0.00	6.00	2.04
No conflict but female dominant	0.82	0.00	0.00	0.00	0.00	0.00	0.81	0.00	0.00	0.00	0.00	0.00
No conflict joint decision making	88.52	80.61	77.36	80.77	75.25	89.00	83.74	81.82	79.81	84.31	77.00	89.80
Conflict male submissive	0.00	1.02	1.89	0.00	0.99	0.00	0.81	1.01	3.85	0.00	1.00	0.00
Conflict female submissive	0.00	1.02	0.00	0.00	0.99	0.00	0.00	1.01	0.00	0.00	1.00	0.00
Conflict male dominant	4.10	8.16	11.32	14.42	7.92	7.00	7.32	6.06	9.62	10.78	8.00	7.14
Conflict female dominant	0.00	4.08	2.83	0.96	4.95	0.00	0.81	4.04	1.92	0.98	5.00	0.00
Conflict equal claim	0.82	0.00	0.00	0.96	0.99	0.00	0.00	0.00	0.00	0.00	1.00	0.00
Conflict indecisive	5.74	4.08	4.72	2.88	0.99	2.00	6.50	5.05	2.88	3.92	1.00	1.02
	Buying selling land and other property						Participation in institutions and other groups					
No conflict but male dominant	0.00	0.00	1.00	1.89	4.90	2.83	0.00	0.00	0.00	0.00	2.94	1.15
No conflict but female dominant	1.61	0.00	0.00	0.00	0.00	0.00	3.31	2.86	2.86	1.14	0.98	0.00
No conflict joint decision making	84.68	78.57	80.00	83.96	75.49	76.42	76.03	75.24	73.33	80.68	70.59	80.46
Conflict male submissive	1.61	3.06	5.00	0.94	3.92	1.89	0.00	0.00	0.00	2.27	2.94	3.45
Conflict female submissive	0.00	0.00	1.00	0.00	0.98	1.89	4.96	2.86	2.86	2.27	3.92	1.15
Conflict male dominant	5.65	8.16	6.00	7.55	6.86	13.21	3.31	4.76	5.71	9.09	4.90	9.20
Conflict female dominant	0.00	5.10	3.00	0.94	2.94	0.94	6.61	12.38	9.52	1.14	4.90	2.30
Conflict equal claim	0.00	1.02	2.00	0.00	1.96	0.00	1.65	0.95	2.86	1.14	2.94	0.00
Conflict indecisive	6.45	4.08	2.00	4.72	2.94	2.83	4.13	0.95	2.86	2.27	5.88	2.30
	Money received from food crop sales						Money received from cash crop sales					
No conflict but male dominant	1.65	1.02	2.06	1.04	5.15	3.96	0.89	1.04	3.23	3.33	7.69	2.11
No conflict joint decision making	81.82	73.47	80.41	81.25	71.13	82.18	83.04	73.96	79.57	80.00	72.53	80.00
Conflict male submissive	0.00	3.06	2.06	0.00	4.12	0.99	0.89	3.13	3.23	1.11	3.30	2.11
Conflict female submissive	0.00	0.00	2.06	0.00	1.03	0.00	0.89	2.08	1.08	0.00	2.20	1.05
Conflict male dominant	9.92	10.20	6.19	11.46	6.19	11.88	10.71	10.42	7.53	11.11	4.40	12.63

Conflict female dominant	2.48	6.12	3.09	1.04	5.15	0.00	0.00	5.21	1.08	0.00	3.30	0.00
Conflict equal claim	0.00	2.04	1.03	1.04	2.06	0.00	0.00	0.00	1.08	1.11	2.20	1.05
Conflict indecisive	4.13	4.08	3.09	4.17	5.15	0.99	3.57	4.17	3.23	3.33	4.40	1.05

Note: The boxes highlighted in darker shades is for higher share in each categories and in lighter shades is for the ones discussed in the draft.

Appendix

Table A1. Probit model results of factors determining selection in treatment

	Variables	Effect 1		Effect 2		Effect 3		Effect 4		Effect 5		Effect 6	
		Coef.	P> z	Coef.	P> z	Coef.	P> z	Coef.	P> z	Coef.	P> z	Coef.	P> z
1	Sex of the household head	0.500	0.017	0.551	0.001	-0.337	0.138	0.143	0.408	0.408	0.092	0.590	0.000
2	Age of the household head	0.086	0.091	0.037	0.406	0.151	0.008	0.036	0.388	0.001	0.985	0.067	0.012
3	Age square of the household head	-0.001	0.082	0.000	0.488	-0.002	0.003	0.000	0.390	0.000	0.972	-0.001	0.010
4	Household head education	-0.252	0.223	-0.401	0.017	-0.078	0.719	-0.203	0.238	-0.172	0.383	-0.309	0.010
5	Migrant	0.010	0.967	-0.043	0.824	0.321	0.199	0.070	0.736	-0.499	0.051	-0.019	0.892
6	Caste OBC	0.302	0.291	0.207	0.377	-0.099	0.732	-0.013	0.959	0.392	0.119	0.149	0.343
7	Caste ST	0.803	0.032	0.280	0.314	0.104	0.768	0.024	0.937	0.667	0.079	0.520	0.016
8	Caste SC	0.453	0.149	0.520	0.046	0.174	0.609	0.377	0.168	0.581	0.051	0.272	0.133
9	Family members	-0.034	0.369	-0.015	0.648	0.011	0.793	0.019	0.580	0.042	0.234	0.013	0.552
10	Agricultural asset	0.103	0.052	0.087	0.029	0.081	0.118	0.095	0.026	-0.010	0.852	0.026	0.381
11	Non-Agricultural assets	0.049	0.415	0.011	0.809	-0.108	0.059	-0.066	0.200	-0.014	0.829	0.030	0.380
12	Total land holding	1.187	0.073	-0.019	0.974	0.494	0.426	-0.033	0.953	0.789	0.153	-0.417	0.222
13	Cultivated land	-0.709	0.263	0.270	0.653	-0.022	0.974	0.480	0.416	-0.769	0.183	0.197	0.578
	Constant	-3.496	0.009	-2.412	0.033	-2.874	0.045	-0.836	0.428	-0.458	0.688	-1.771	0.012

Note: Refer table 3 for understanding the Effect categorization.

Table A2. Estimation of ATT of unitary model using alternative estimators

Effect	NN matching		Radius matching		Kernal matching	
	ATT	P value	ATT	P value	ATT	P value
1	0.051	0.635	0.050	0.431	0.051	0.503
2	0.055	0.400	0.050	0.332	0.046	0.359
3	0.009	0.923	0.075	0.230	0.081	0.306
4	0.071	0.330	0.093	0.114	0.095	0.070
5	0.130	0.055	0.118	0.014	0.116	0.052
6	0.096	0.032	0.112	0.001	0.098	0.009

Notes: The ATT estimated using The NN (Nearest Neighborhood) matching, Radius matching (Caliper 0.01) and Kernal Matchinh (Bandwidth = 0.01) were obtained using 'psmatch2' command in stata (Leuven and Sianesi, 2003).

Table A3. Rosenbaum bounds sensitivity analysis

Critical value of unobserved heterogeneity	Effect 1	Effect 2	Effect 3	Effect 4	Effect 5	Effect 6
1	0.075	0.167	0.150	0.001	0.328	0.026
2	0.000	0.000	0.000	0.000	0.000	0.000
3	0.000	0.000	0.000	0.000	0.000	0.000
4	0.000	0.000	0.000	0.000	0.000	0.000
5	0.000	0.000	0.000	0.000	0.000	0.000

Figure A9. Type of conflict with regard to decision making on Borrowing and lending money

