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Does the heterogeneity of project implementers affect the program participation of beneficiaries? : Evidence from rural Cambodia

Ayako Wakano[†], Hiroyuki Yamada[§], and Daichi Shimamoto[††]

Abstract

Using the dataset collected for assessment of a post-harvest technology project in rural Cambodia, we focused on the heterogeneous social preferences of project implementers, often overlooked in the literature of Randomized Controlled Trials (RCT). Our study focuses on the "implementer effect" on program participation for the treated farmers. We show the possibility that heterogeneous program participation of ordinary farmers across the treated villages could be induced due to heterogeneity in the characteristics of project staff. In particular, we show the altruism of project staff, measured by the dictator game, consistently increases participation and the number of participations in the training sessions of beneficiaries. This type of heterogeneity in project staffs' preferences across treatment sites might yield noises in mean effects estimated using RCT methods conducted at a certain cluster level, which undermines the external validity of the estimated results. While RCT methods are very powerful tools for many program and policy evaluations, we cannot emphasize too much the importance of the way how an actual project is implemented.

JEL code: O22, C93, D03,

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1. Introduction

In program evaluation studies, empirical researchers often use Randomized Controlled Trials (RCT) to estimate the treatment effects of development projects. However, one weakness of RCT is its' exclusive focus on mean impact (Ravallion 2012; Deaton 2010). Criticisms indicate that positive and significant mean impact does not guarantee that the program as a whole benefits most of the target population of a project. It may be the case that the program has huge benefits for only a small portion of the population. Heckman et al. (1997) emphasized the importance of looking at the heterogeneous program impacts among the treated population, pointing out that evaluating a program solely by the mean rests on the assumption that "the undesirable distributional aspects of programs are either unimportant or are offset by transfers governed by a social welfare function." In this way, the literature acknowledges the importance of looking at heterogeneity in program impacts, though the mean impact is the only statistic that we obtain from an RCT on those treated in the experimental population without posing further assumptions. Secondly, the literature has extensively studied the case of heterogeneous responses of those targeted by the random program assignment and hence, full compliancy could not be assured in RCT settings (Heckman et al. 1997, 2006).

In this paper, the sources of heterogeneity that we focus on among the treated are the heterogeneous characteristics of project implementers. Even if program is randomly placed prior to the project, that ex-ante randomness might not assure homogeneous characteristics of project staff. A source of heterogeneity may be what Banerjee and Duflo (2008) term "implementer effects." This is realized when implementers of the program, such as local partners or project staff, are different from each other in the first place. This situation is not uncommon for development projects, and while some development projects seem less affected by project staffs, others seem directly involve project staffs in implementation stage. This heterogeneity of project staff could have greater influence especially when those project implementers are involved intensively in the process of implementation of a development project. Indeed, project implementers in villages are often not homogeneous in qualifications and preferences (Ravallion 2012). Hence, the same outcome could not be expected across all sites even if the other characteristics of the treated sites are very similar.

These "implementer effects" were considered an issue in the discussion of external validity of the experimental results, since not all counterparts accept randomization as the implementation manner and not all project implementers are randomly selected. It could be inferred that randomized programs are only carried out by limited types of organizations. To eliminate this "specific implementer effect" and to recover the external validity of the result, it has been noted that replicating randomizations with various implementers is not a

constructive remedy (Banerjee and Duflo 2008). Nevertheless, there still remains a gap in the literature as to what extent the 'implementer effect' influences the results of project interventions. In our study, we quantify the extent to which the characteristics of implementers affect the program participation, by testing whether social preferences of "implementers" affect the program participation of those farmers in the treatment groups.

In six provinces in rural Cambodia, a post-harvest project of the International Rice Research Institute (IRRI) was implemented to improve post-harvest practices and consequently, raise the income of farmers. One approach used was to diversify extension sources and collaborate with "key farmers" or farmer leaders who then provide extension services to other farmers in the village. With its research for development stance, this project provides a case for us to examine the effect of the differences in project implementers across the treated groups.

We used household data collected in rural villages in Cambodia between December 2012 and January 2013 where the IRRI had intervened in post-harvest technology extension programs since 2005. This project has provided post-harvest technology items to rural farmers in the treatment villages, where two local residents were assigned as the project staff in each village. They implement the project, encouraging their own villagers to participate in the training sessions on how to use post-harvest technology items. These local project staffs are called "key farmers." Indeed, they play a key role in spreading the post-harvest technologies among the villagers in the treatment villages. With the experimental measures from the dictator game conducted for the key farmers, our empirical result shows the level of altruism of key farmers is highly associated with the beneficiaries' participation rate and the number of participations in the program. Although we do not formally implement the program evaluation of the post-harvest technology project, this type of heterogeneity across treatment sites might yield noises in mean effects estimated using RCT methods conducted at a certain cluster level. While RCT methods are very powerful tools for many program and policy evaluations, we conclude how a project is implemented has great significance and needed to be considered in program evaluation studies.

The rest of the paper is organized as follows. The next section overviews the related literature. Section 3 explains the background of the post-harvest technology project. Section 4 provides the conceptual framework, mainly focusing on the social preferences of key farmers. Section 5 explores the data and the experiment design. Section 6 shows the empirical analysis and results. The last section provides conclusions and policy implications.

2. Preceding studies

2.1 Program evaluation studies

In program evaluations, one of the virtues of utilizing RCT methods is that we assume unobserved heterogeneity affecting potential outcomes is very similar (or equal) on average for the treated and control groups. However, even if the assignment is random, this does not guarantee the same program implementation manner among the treated groups. In fact, in certain types of programs where project staff are intensively involved in project implementation, the treatment outcome can be heterogeneous because of the heterogeneous working attitudes of project staff, their level of commitment, and skills. If the focus is solely to estimate the "average" treatment effects of the project of interest itself, then it should not be a problem. However, if the degree of heterogeneous impacts is largely influenced by the program implementation manner across the treated groups, the estimated outcomes might not be replicable in different settings, which undermines the external validity of the estimated results.

In the literature, many RCT programs are randomized in certain clusters such as at the school, village, hospital, and districts level, where local project implementers are actively enrolled. For example, Jensen (2012) report evidence from India where "experienced recruiters" were employed, while Angrist and Lavy (2009) report a randomized cash incentive program for low-achievers of high school students in Israel where "teachers and school administrators" are actively enrolled. Duflo et al. (2012) reported an RCT conducted at the school level in Kenya, hiring a "local community teacher." For those studies designed to obtain "project staff" involved in implementation with a greater extent, the different characteristics of project staff at each cluster could be a crucial source of heterogeneous impacts among the treated. Our study focuses on heterogeneous project participation that emerged through the implementation process, which is highly associated with the social preferences of the project implementers.

2.2 Preceding studies on measured social preferences and real life pro-social behavior

Our study is closely related to preceding empirical studies that tested whether the measured social preferences in the laboratory or field experiment are associated with subjects' pro-social behavior in real life (Karlan 2005; Benz and Meier 2008; Carpenter and Cardenas 2008; Carpenter and Myers 2010; Carter and Castillo 2011; Seki and Carpenter 2011; Alberto 2013). Although various pro-social behavior in real life as dependent variables were regressed on the experimental measures in the field or laboratory experiment, none of the studies has tested the relationship between project staffs' social preference and their real life working performance. In our study, we show whether measured social preferences of key farmers such as altruism and reputational concerns can be predictors of their real-life working outcome of providing training sessions.

3. Program Background

3.1 Overview of the program,

The project that we studied was implemented by the IRRI funded by the Asia Development Bank (ADB). According to the IRRI, post-harvest losses in Southeast Asian countries are not ignorable in scale, typically 15-20% in weight loss and, when quality is factored in, can result in a 10-30% loss of value in the market. In order to tackle this post-harvest loss, the project in Cambodia was implemented as one component of a broader program, covering Vietnam, the Philippines, and Cambodia. In Cambodia, the program has intervened since 2005 in four villages in Prey Veng Province located in the eastern part and four villages in Battambang Province, located in the northwestern part of Cambodia. From 2008, this initial project was expanded to the four additional provinces in Cambodia: Pursat, Kampong Thom, Takeo and Kampot Provinces. As a result, as of 2012, the project has reached 13,000 households. We surveyed 14 treated villages scattered in four (Battambang, Prey Veng, Pursat, and Takeo) provinces in Cambodia between December 2012 and January 2013[1]. We collected information of 235 households of rice farmers and 27 key farmers, two in each of 14 villages[2].

There were two different types in the provision of post-harvest technology items: one was provided at the household level, and the other was provided at the village level, such as weighting scales, moisture meters, thermometers, and cleaners[3]. The farmers use 150-kg weighing scales in their transactions with buyers. Moisture meters and thermometers are used to check the quality of dried grains and seeds. Cleaners are used to remove impurities mixed with grains before broadcasting. For those four items provided at the village level, only one of each item was provided to each treatment village, and the project staff, called key farmers, were assigned to maintain and lend items to their own villagers after providing them with a training session.

3-2. Project implementation: The role and characteristics of “key farmers”

In order to encourage ordinary farmers to use the provided items in the treatment villages, two local key farmers were selected in each of the treatment villages by the

[1] There are in total 20 treatment villages and 6 control villages under the project. We were unable to survey two provinces (Kampong Thom and Kampot) due to budget constraints of the project.

[2] At the time of the survey, one key farmer was absent in the village called Por Chery; therefore, the total number of surveyed key farmers is 27.

[3] Other provisions from the IRRI not listed are as follows: for harvesting, mini-combine harvesters were introduced at the selected villages; 5-ton cube or cocoons and granary improvements were also provided at selected villages. A market information system where price data was collected every three days in three different markets (rural, provincial, and Phnom Penh) was also set up to help farmers get better selling prices.

Provincial Department of Agriculture (PDA), the counterpart of the Ministry of Agriculture in the central government and IRRI project staff. Locally assigned key farmers have played a key role in spreading the technologies introduced by the project. Key farmers reported the feedbacks about the usage of the provided item for periodical visits of PDA and IRRI staff at treatment villages. Key farmers were also asked to show their records on demonstration or trials and villagers' history of using the provided items. Key farmers had to submit their written reports to PDA and IRRI project staff when they conducted training sessions for villagers.

In this way, the selection of key farmers was crucial for the successful implementation, and hence carefully performed by the PDA based on criteria such as willingness to work with the project and abilities to communicate with villagers. Out of 27 key farmers that we surveyed, one quarter of them were an experienced village leader or belonged to a village leader family. Half of them had worked as a public worker before being selected as a key farmer. Over 35% of them answered that they were interested in other public worker positions, such as a member of a development committee that exists in each commune, and over 82% of them said they would like to run for election if there were an election to select key farmers in their village. Hence, we observed that those selected key farmers are in general highly motivated to work for public issues.

Table 1

Table 1 shows the basic characteristics of key farmers and ordinary farmers. In terms of off farm income, key farmers earn more (an average of 8.4 million riel) than ordinary villagers (the average is approximately 5 million riel)[4]. The number of members in a key farmer's household is similar to that of ordinary villagers, with an average of 5.4 members. The average number of years of education of key farmers is 6.7 years, which is higher than that of household heads of ordinary farmers. The average age of key farmers is four years older than that of household heads of ordinary households, implying that more experienced or senior persons are chosen as key farmers. There were more male than female key farmers.

4. Conceptual framework: role of "key farmers" innate preference and incentive

As mentioned earlier, we assume that the heterogeneity among project staff could be an important factor determining project participation and outcome. In this section, we explain why social preferences, that is, altruism and image of social sanction or social reputation affect the level of pro-social behavior of key farmers.

[4] As of 31 December 2012, US$1 is equivalent to 3,909.4 Cambodian Riel.

In the literature, the motivations for ones' pro-social behavior, which is costly to them but primarily benefit others, was extensively studied. There are two categories of motivations; one is the intrinsic motivations such as innate preferences and the other is the extrinsic motivations such as material rewards or benefits associated with acting prosaically (Becker, 1974, Andreoni, 1989, 1990). In our context, the extrinsic incentive is not explicitly embedded in the project that forces key farmers to commit to their roles. For example, no written official contract exchanged between key farmers and IRRI/provincial counterparts, nor any financial incentives are given to accomplish their roles, except a one-off payment of 10 US dollars to purchase phone cards in order to communicate with other villagers.

On the other hand, for key farmers who care about the self-image or reputation from villagers, there could be an implicit mechanism to make them work since they are constantly exposed to monitoring by ordinary farmers in their village. While monitoring by PDA and IRRI project staff is rare, ordinary villagers would notice the working attitudes of key farmers. In this sense, their extrinsic motivation is not about the financial benefits, but social reputation or sense of sanction from their own villagers is at work, for most of them are greatly concerned about public issues and interested in working as public workers future.

In the literature, "anonymity effect" or "signaling effect" models propose similar type of motivations to explain one's pro-social behavior in the presence of others. In the anonymity effect, models predict that people supply an increased level of labor or provide charitable donations with the presence of others (Meer (2011), Dellavigna et al. (2012)). The signaling model (Benabou and Tirole, 2006) specifically explains the pro-social behavior as signaling to be perceived as an "altruistic" person in the presence or under the observation of others. The "enforced reciprocity model" by Leider et al. (2009, 2007) pays attention to the effect of subjects' expectations of reciprocal favors in future exchanges. Compared to altruism, we name such social consideration as the reputation concerns or sense of sanction, which induces pro-social behavior in the presence of others. Following the studies of Ligon and Schechter (2012) and Leider et al. (2009), we measure two motivations of altruism and reputation concerns elicited by the dictator game experiment.

Based on the literature, both altruism and a sense of sanction or reputational concerns could induce one's pro-social behavior; however, which one has more explanatory power for the variation in the level of pro-social behavior or whether they work complimentarily or work as a substitute for providing pro-social behavior is uncertain. Therefore, we included reputational concerns as well as altruism of key farmers at the same time to test which effect has more explanatory power for the variation in the level of pro-social behavior. Furthermore, we tested whether altruism and reputational concerns can function

complimentarily at the level of pro-social behavior by adding the interaction of the two.

5. Data

5-1. Survey design

We conducted the household survey from December 2012 to January 2013 in 14 treatment villages in four provinces, namely Battambang, Prey Veng, Pursat, and Takeo. In each treatment village, we surveyed ordinary farmers, which amounted to 235 households in total, and 27 key farmers. The survey was conducted by 10 IRRI recruited Cambodian enumerators with our field team and IRRI project staff, independently from the project intervention. To sample households randomly, we worked with PDA officials and IRRI project staff to draw up a list of 11 to 32 households that had been randomly selected and interviewed by the previous monitoring and evaluation surveys[5]. Table 2 shows the household samples interviewed by our survey in each village.

Table 2

Interviews took place in a public space in each village, and the household head or head's wife was asked to complete a household questionnaire. The key farmer interview took place at the same time as the interviews of household heads or the head's wife. A pair of an interviewee and an enumerator was instructed to sit apart from other pairs so that each other's interviews could not be heard. We were especially cautious in the interviews with key farmers so that they could not be heard by anyone attending the household interviews since the key farmers' questionnaire contains the experiment section. Both key farmers and respondent ordinary farmers received a gift at the end of the interview.

5-2. Experiment with key farmers and descriptive statistics of item-carrying key farmers

The field experiment was conducted for every key farmer during the interviews with him/her. In order to elicit social preferences, we conducted the dictator game virtually. In the dictator game setting, the first-mover simply makes a transfer to a passive second-mover. If the game is anonymous, the voluntary transferred amounts are, in general, interpreted as measures of altruism, assuming there is no self-interested reason for the first-mover to transfer money. Following the literature of Ligon and Schechter (2012), in our setting, key

[5] Previously, for the purpose of monitoring and evaluation of the project, household surveys were conducted 4 times from 2005 to 2008. Details of the previous monitoring result are available in the report, "Report on technology adoption, lessons learned and impact of the IRRI ADB-JFPR 9036 Project," IRRI (2009). We attempted to resurvey all the households in earlier intervention provinces (Battambang and Prey Veng), surveyed lastly in 2008 and all the households in later intervention provinces (Pursat and Takeo), surveyed lastly in 2009. However, there was some attrition of households due to migration and other reasons. In such cases, replacement households were randomly chosen in each village.

farmers were asked to play the role of dictator in three different settings of the dictator game.

The baseline setting of the dictator game is as follows: the game is played in pairs, of which Player 1 is the dictator (key farmer) and Player 2 is someone specified in each game. At the start, Player 1 receives 40,000 Cambodian riel (equivalent to 10 US dollars) as an endowment. Player 1 decides how much he/she wants to keep and how much he/she wants to send to Player 2. Player 1 can send an amount between 0 riel and 40,000 riel to Player 2. Any money sent to Player 2 will be doubled. Player 2 will receive any money Player 1 sent multiplied by two, plus an additional contribution of 3,000 riel given by the project staff.

Using the above setting, we asked key farmers to play three different versions of the game. In the first version, Player 2 (the recipient) is randomly chosen from Cambodia by lottery and the dictator does not know who Player 2 is and Player 2 does not know who the dictator is. In the second version, Player 2 is randomly chosen from households in the key farmer's village by lottery. The dictator again does not know who Player 2 is and Player 2 does not know who the dictator is, either. Finally, Player 2 is randomly chosen from households in the village by lottery, which is the same condition as Version 2. However, Player 2 does know who the dictator is and the amount set to be transferred by the key farmer though the dictator does not know who Player 2 is.

According to the preceding study of Ligon and Schechter (2012), we defined the amount measured from Version 1 as "general altruism," which is the amount of voluntary transfer to the randomly selected person. In contrast, "villager-directed altruism" is defined based on the amount measured from Version 2. "Reputational concern" or "sense of social sanction" is defined as the amount measured from Version 3 minus the amount measured in Version 2. The only difference between Version 2 and 3 is whether Player 2 knows who the dictator is. Hence the difference in amount between Versions 2 and 3 is defined as the amount for "social consideration" or "reputational concern" (Ligon and Schechter 2012).

Table 3

In the 14 villages that we surveyed, there are two key farmers assigned to work for the project. In each village, one of the key farmers is identified as the "Item-carrier" key farmer who mainly keeps those provided items and lends them to ordinary farmers. In our estimation, we used the social preference measures of 13 item-carrier key farmers, since 1 item-carrier key farmer was absent at the time of the survey. Table 3 shows the descriptive statistics for 13 item-carrier key farmers. Both altruism and reputational concerns are experimental measures obtained by the dictator game and have large variation in values[6].

[6] In the estimation, we take the logarithm for the experimental measures of reputational

The mean of general altruism is 4,338 riel with a standard deviation of 8,223 riel and that of village-directed altruism is 5,684 riel with a standard deviation of 10,713 riel. The mean of reputational concern is 1,846 riel with a standard deviation of 3,078 riel. This shows the minimum value of reputational concern is zero, which implies all key farmers have increased an amount to transfer in the non-anonymous setting. In the estimation, we used the demeaned value. The mean (in log) of each variable is subtracted from the log of the altruism measure or log of reputational concern measure so that, in our estimation, the interpretation of the coefficient of altruism (in log), reputational concern (in log) and the interaction term are made straightforward. The income level of key farmers and years of education vary greatly, both variables of which are included as control variables.

5-2. Descriptive Statistics

Table 4 shows the descriptive statistics on the ordinary farmers. Due to the missing values, total effective samples for some variables are not the 235 samples that we surveyed. Our dependent variables are of two types. One is whether the ordinary farmers have ever participated in the training sessions conducted by key farmers. The other is how many times they have participated in the training sessions conducted by key farmers. The mean participation rate is 0.67, meaning that 67% of ordinary farmers surveyed have participated in the training sessions at least once. The systematic characteristic difference between participants and non-participants is not observed, according to the simple mean comparison test as is shown by Table 5. As for the number of participations, the mean is 3.37 times with great variation. This variation cannot be explained only by difference across villages as shown by Figure 1, implying we have to control within village variations such as the characteristics of ordinary farmers.

Table 4, 5

Explanatory variables are item-carrying key farmers' characteristics and ordinary farmers' characteristics as shown in Tables 3 and 4. For ordinary farmers' characteristics, consultation with a key farmer is the binary answer to the question of "Are you able to consult key farmers when you have farming-related questions?" This is a proxy variable to capture the subjective psychological distance or level of trust from ordinary farmers to key farmers. Previous studies have shown that having informal conversations or discussions leads to increased cooperation and reduced extraction in the experiment (Cardenas and Carpenter 2008). Physical distance is the distance between key farmers' residences to villagers' residences. Since the training sessions offered by key farmers is mainly held at key farmers'

concern and altruism. The calculation is performed as follows: log altruism = log(altruism+(altruism^2+1)^(1/2)). This is because some key farmers have set their transfer amount to zero.

residences, controlling the distance to key farmers' residences has great significance, as distance is considered to be one of the costs for ordinary farmers to participate in training sessions. The average distance between a key farmers' house and an ordinary farmers' house is 410 meters with a large variance within a village. In order to control for the farmers harvesting activities, the number of times of rice growing in one year is included. On average, ordinary farmers grow rice 1.7 times in a year. Our province dummy captures the effect of the length of the project intervention since four provinces have different intervention periods.

6. Empirical Analysis and Result

6-1. Estimation result from ordinary least squares estimations

First, we estimated the following linear regressions regardless of whether the dependent variables are binary or continuous. A limited dependent variable model yields nearly identical results as shown in Section 6-2. The estimated linear model is as follows:

$$Y_{iv} = X_v\alpha + Preference_v\beta + H_{iv}\gamma + \delta_p + \mu_{iv}$$

where i denotes ordinary farmer and v denotes village. Y_{iv} denotes whether the ordinary farmers have ever participated in the training sessions conducted by key farmers , or the number of participations in the training sessions conducted by key farmers. X_v denotes the characteristic variables of an item-carrying key farmer in village v, such as years of education and log of annual income. $Preference_v$ denotes the social preferences of item-carrying key farmers in village v, that is, the log of altruism, reputational concern, and the interaction term of the two. H_{iv} denotes the household characteristics of ordinary farmer i in village v. Those household characteristics include the physical distance to the item-carrying key farmer, the consultation dummy, the log of off-farm annual income, the number of rice harvests per year, age, sex and years of education of household head and the number of household members. δ_p denotes the provincial dummies. The standard errors are clustered at the village level.

Table 6

Table 6 shows the estimation result for training participation. The dependent variable is binary: either zero or one. Y_{iv} takes 1 if ordinary farmers have ever participated in the training sessions and zero otherwise. We estimated four different versions of the linear probability model (LPM): (1) base models, (2) those including key farmers' characteristics in the base models, (3) those including the interaction term of altruism and reputational concern in the base models, and (4) those including both key farmers' characteristics and interaction terms in the base models. The base model includes altruism and reputational concern variables of the key farmers, ordinary farmers' characteristics and province dummies. The

base models show that the coefficient of altruism and reputational concern are consistently positive and statistically significant. A one percent increase in altruism leads to about a three percent increase in the participation rate of ordinary farmers while a one percent increase in reputational concern leads to about a one percent increase in participation rate. After adding the physical distance between key farmers and ordinary farmers' residences and consultation dummy, both altruism and reputational concern remain significant. The dummy of consultation does not affect the participation. The sign of coefficient for physical distance is negative, though not statistically significant.

Columns 5 to 8 of Table 6 show the estimation results of the second models including the key farmers' characteristics as control variables in the base model. The coefficient of education years for key farmers is consistently positive and significant while the log income of key farmers is positive, but not statistically significant. The significance of the coefficient of reputational concern becomes marginal though the sign remains positive once key farmers' education level and income are included. In contrast, the coefficients of altruism are consistently positive and statistically significant at the one percent level.

Columns 9 to 12 of Table 6 show the estimation results of the third models including the interaction term of altruism and reputational concern in the base models. The coefficients of the interaction term as well as those of altruism are statistically significant at the one percent level. Furthermore, the coefficients of reputational concern, though the magnitude is smaller than that of the base models, are positive and statistically significant. This suggests that when key farmers are altruistic and also consider their social reputation at the same time, they are likely to be more motivated to encourage ordinary farmers' participation in the training sessions. In other words, altruism and reputational concern work complimentarily.

Columns 13 to 16 of Table 6 show the estimation results of the last models including the key farmers' characteristics and interaction term in the base models. The altruism is statistically significant at the one percent level, though the reputational concern is positive but not significant in some cases. Compared to the third models, after controlling for the key farmers' characteristics, the effect of reputational concerns becomes marginal. However, when we conduct the Wald test for the effect of reputational concern of each key farmer, we reject the null hypothesis that the effect is not different from zero for 9 out of 13 key farmers at the five percent level. That is, the statistics of

$$(\text{Coefficient of reputational concern}) + (\text{Interaction term of altruism and reputational concern}) * \text{altruism}_v \quad \text{(A)}$$

are significantly and positively different from zero for 9 key farmers. This result indicates that though the impact on participation of reputational concern on average is marginal, its full impact is still positively significant for the majority of key farmers.

Table 7

The estimation results on the number of participations in training sessions are shown in Columns 1 to 16 of Table 7. We estimate the same specification as LPM (other than the dependent variable). The qualitative results are slightly different from those of LPM on participation. The main difference is that the coefficient of reputational concern is negative although not statistically significant. In contrast, the altruism and interaction term between altruism and reputational concern remain positive and statistically significant at the 5 percent level at least. We conducted the same Wald test for the statistics (A) above. We can reject the hypothesis that reputational concern positively impacts the number of training sessions for the case of 4 key farmers out of 13. This suggests that for some key farmers, the reputational concern still has a significant effect on the number of participations, though on average, the impact of reputational concern is marginal.

The consultation dummy is consistently positive and significant at the five percent level. If ordinary farmers have consulted key farmers, that increases the number of participations in training sessions by approximately 1.5 times on average. This is consistent with the results from the literature, which shows that the more informal the interaction between neighbors, the more they try to contribute to the community. Lastly, in the estimation of number of participations, the years of education of key farmers became negative and significant at the 10 percent level in some specifications. This is intuitively understandable: if key farmers are more educated, ordinary farmers have less need to participate in training sessions because such key farmers can provide better training sessions to ordinary farmers, leading to a reduction in the number of necessary training sessions. In other words, it can be inferred that key farmers with a higher education level are better at teaching or giving training sessions.

6-2. Type I Tobit model

Samples taking zero participation might be systematically different from non-zero samples. Therefore, assuming that the data is censored at Y_{iv} equals zero, we show the censored regression model to confirm the robustness of the OLS estimation results. We applied the type I Tobit model.

Table 8

Table 8 shows the result of the Type I Tobit model. Similar to both the estimation results on participation and the number of training sessions, altruism and the interaction term between altruism and reputational concern remain positive and statistically significant. The statistical significance of reputational concern does not appear in the Tobit model result. However, by the Wald test for reputational concern for the statistics (A) above, we can reject the case of 5 key farmers out of 13 for models 13 to 16. Therefore, though on average the effect of reputational concern is marginal, it has a statistically significant effect on the number of participations in some cases, same as the LPM and OLS models described in Section 6-1.

6-3. General Altruism

As explained in the conceptual framework, we also tested whether "general altruism" has explanatory power on key farmers' pro-social behavior. The purpose is to test whether a key farmer's activity is truly driven by his/her altruism. Because "villager directed" altruism is elicited in an anonymous setting (within a village), if key farmers work pro-socially for the reciprocal concerns only toward the villagers, the estimated coefficient of "general" altruism and that of "villager" directed altruism should largely differ. Put differently, it could be inferred that the coefficient of "villager directed" and "general" altruism should not largely differ if key farmers are motivated by "true" altruism.

Table 9, 10

Table 9 shows the result of LPM with the dependent variable of participation and Table 10 shows the result of ordinary least square estimation with a dependent variable of the number of participations. Since we did not conduct an experiment to elicit reputational concern measures when Player 2 (the recipient) was randomly chosen from Cambodia by lottery, we did not include any reputational concern or interaction term in Tables 9 and 10. In LPM on participation, general altruism was consistently positive and significant at the 1 percent level. Moreover, the magnitude of the coefficients of altruism in Table 9 are not much smaller than those in Table 6, implying key farmers' "true" altruism, which is measured as "general altruism" in our setting, is important for participation in training sessions. As for the number of participations, Table 10 shows similar results to Table 7 although the coefficient of general altruism is marginally significant in two specifications. However, judging from these results shown in Tables 9 and 10, we may conclude that key farmers' true altruism is highly associated with better participation and frequency of training sessions.

7. Conclusions and policy discussions

We focused on the heterogeneous social preferences of project staff, often overlooked in previous RCT, and examined whether they yield heterogeneity among beneficiaries' participation and the number of participations in training sessions. Our results showed that the social preference of project staff measured by the field experiment is highly associated with the program participation and the number of participations of project beneficiaries. Among them, the altruism of project staff (key farmers) consistently increases participation and the number of participations in the training sessions of beneficiaries.

Our empirical results clearly show the possibility that heterogeneous program participation of ordinary farmers in treated villages could be induced due to heterogeneity in the characteristics of project staff. Although we did not formally implement the program evaluation of the post-harvest technology project, this type of heterogeneity across treatment sites might yield noises in mean effects estimated using RCT methods conducted at a certain cluster level. If the degree of heterogeneous impacts were largely influenced by a program implementation manner across the treated groups, the estimated outcomes might not be replicable in different settings, which undermine the external validity of the estimated results. While RCT methods are very powerful tools for many program and policy evaluations, we cannot emphasize too much on the importance of project implementation manner.

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Table 1: Descriptive statistics of key farmers and ordinary farmers

Variable	[Key Farmer] Obs	Mean	Std. Dev.	Min	Max	[Ordinary Farmers] Obs	Mean	Std. Dev.	Min	Max	T value (H0: Diff=0)
Off farm income (1 million Riel)	27	8.45	9.27	0.40	41.00	231	4.93	5.84	0.00	403.00	2.76
Number of household members	27	5.41	1.62	2	9	235	5.25	1.69	2	12	0.47
Years of education	27	6.70	3.60	0	14	228	6.09	3.81	0	18	0.80
Sex	27	0.93	0.27	0	1	231	0.90	0.31	0	1	0.49
Age	27	54	10.13	33	75	231	49.20	12.48	23	76	1.92

Table 2: Household samples surveyed from December 2012 to January 2013

Province	Village name	Obs
Prey Veng	Ansorng	16
	Bantealbos	15
	Chrey veal	15
	Por Chrey	16
Pursat	Pre Kdey Krorm	11
	Pre Kdey Leu	11
	Preah Chambann	32
Takeo	Svay Russey	31
	Veang	15
	Doung	14
Battambang	Salatrav	17
	Samrong snor	15
	Snapimok	12
	Balat	15
Total		235

Table 3: Descriptive statistics for item-carrying key farmers

Variable	Obs	Mean	Std. Dev.	Min	Max
General altruism (Riel)	13	4,338.46	8,223.29	0	30,000
Village-directed altruism (Riel)	13	5,684.62	10,713.38	0	40,000
Reputational concern (Riel)	13	1,846.15	3,078.05	0	10,000
Years of education	13	16.89	0.53	15.99	17.98
Log income (Riel)	13	7.31	3.95	0	14

Table 4: Descriptive statistics for ordinary farmers

Variable	Obs	Mean	Std. Dev.	Min	Max
[Dependent Variable]					
Participation	235	0.67	0.47	0	1
Number of Participation	235	3.37	3.47	0	20
[Independent Variable: Beneficiary characteristics]					
Consultation to key farmer (=1 if yes, zero otherwise)	230	0.91	0.29	0	1
Physical distance to key farmer (km)	235	0.41	0.46	0	2.42
Number of times of rice growing	235	1.71	0.71	1	3
Log of off-farm income for household	231	15.33	2.32	0	18.21
Sex of household head (=1 if male and female otherwise)	231	0.90	0.31	0	1
Age of household head	231	49.20	12.48	23	76
Education years for household head	228	6.09	3.81	0	18
Number of household members	235	5.25	1.69	2	12
Province Dummy (Prey Veng)	235	0.26	0.44	0	1
Province Dummy (Pursat)	235	0.23	0.42	0	1
Province Dummy (Takeo)	235	0.26	0.44	0	1

Table 5: Descriptive statistics for participants and non-participants

	Training Participant			Non Training Participant			T value
Variable	Obs	Mean	Std. Dev.	Obs	Mean	Std. Dev.	(H0: Diff=0)
Consultation to key farmer (=1 if yes, zero otherwise)	155	0.903	0.297	75	0.920	0.273	-0.41
Physical distance to key farmer (km)	158	0.423	0.472	77	0.377	0.440	0.72
Number of times of rice growing	158	1.722	0.713	77	1.701	0.708	0.20
Log of off-farm income for household	157	15.220	2.420	74	15.548	2.077	-1.00
Sex of household head (=1 if male and female otherwise)	157	0.911	0.286	74	0.865	0.344	1.07
Age of household head	157	49.834	12.514	74	47.865	12.397	1.12
Education years for household head	155	6.148	3.949	73	5.959	3.514	0.35
Number of household members	158	5.215	1.739	77	5.312	1.608	-0.41

Table 6: Estimation result for participation by linear probability model

Dependent variable	①Base model				②Base model + Key farmer characteristics				③Base model + Interaction term				④All			
Participation	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16
Altruism (log)	0.0298	0.0304	0.0315	0.0321	0.0273	0.0283	0.0294	0.0304	0.027	0.0274	0.0287	0.0288	0.026	0.0267	0.0273	0.0277
	[3.34]***	[2.98]**	[3.39]***	[2.93]**	[7.12]***	[6.10]***	[6.42]***	[5.28]***	[9.45]***	[8.33]***	[9.32]***	[7.90]***	[8.04]***	[7.04]***	[7.64]***	[6.56]***
Reputational concern (log)	0.0116	0.0128	0.0089	0.0102	0.0064	0.0077	0.0046	0.006	0.0088	0.0099	0.0059	0.0069	0.0064	0.0078	0.0044	0.006
	[3.72]***	[3.55]***	[2.86]**	[2.89]**	[1.61]	[1.75]	[1.05]	[1.22]	[3.00]**	[2.89]**	[1.89]*	[1.79]*	[1.76]	[1.95]*	[1.18]	[1.41]
Years of Education of key farmer					0.0146	0.0161	0.0133	0.0147					0.008	0.0079	0.0018	-0.0003
					[4.69]***	[4.06]***	[3.25]***	[3.09]***					[1.53]	[1.20]	[0.29]	[-0.05]
Log income of key farmer					0.0506	0.0417	0.0402	0.0281					0.0519	0.0426	0.0423	0.029
					[1.15]	[0.87]	[0.95]	[0.61]					[1.14]	[0.86]	[0.93]	[0.60]
Interaction term of altruism and Reputational concern									0.0029	0.0035	0.0031	0.0039	0.002	0.0025	0.0033	0.0043
									[6.51]***	[4.59]***	[6.63]***	[4.65]***	[2.07]*	[1.80]*	[3.15]***	[3.84]***
Physical distance to key farmer		-0.0536		-0.0798		-0.0695		-0.0934		-0.0805		-0.1109		-0.0757		-0.108
		[-0.98]		[-1.46]		[-1.50]		[-2.05]*		[-1.56]		[-2.18]**		[-1.48]		[-2.04]*
Consultation to key farmer			-0.066	-0.074			-0.0597	-0.069			-0.0576	-0.0665			-0.0556	-0.0647
			[-0.55]	[-0.63]			[-0.49]	[-0.58]			[-0.48]	[-0.56]			[-0.45]	[-0.54]
Number of times of rice growing	-0.0354	-0.0316	-0.0339	-0.0246	-0.0365	-0.034	-0.0371	-0.0294	-0.0404	-0.035	-0.0396	-0.028	-0.0354	-0.0319	-0.0341	-0.024
	[-0.66]	[-0.62]	[-0.66]	[-0.52]	[-0.67]	[-0.64]	[-0.68]	[-0.57]	[-0.76]	[-0.69]	[-0.76]	[-0.58]	[-0.64]	[-0.61]	[-0.62]	[-0.47]
Log of off-farm income for household	-0.0134	-0.0143	-0.0129	-0.0143	-0.0122	-0.013	-0.0117	-0.0129	-0.0133	-0.0146	-0.0129	-0.0147	-0.013	-0.0141	-0.0132	-0.0151
	[-0.81]	[-0.89]	[-0.78]	[-0.88]	[-0.73]	[-0.81]	[-0.69]	[-0.79]	[-0.79]	[-0.91]	[-0.77]	[-0.91]	[-0.76]	[-0.87]	[-0.76]	[-0.90]
Sex of household head	0.1047	0.1054	0.103	0.1048	0.0956	0.0931	0.0958	0.0942	0.098	0.0984	0.0965	0.0975	0.0994	0.0981	0.1012	0.1016
	[0.80]	[0.78]	[0.81]	[0.80]	[0.75]	[0.71]	[0.77]	[0.74]	[0.76]	[0.74]	[0.77]	[0.75]	[0.78]	[0.74]	[0.81]	[0.79]
Age of household head	0.0028	0.0028	0.0023	0.0023	0.0029	0.0029	0.0024	0.0024	0.0027	0.0027	0.0022	0.0023	0.0029	0.0028	0.0024	0.0024
	[0.93]	[0.93]	[0.78]	[0.81]	[0.98]	[0.98]	[0.83]	[0.86]	[0.92]	[0.92]	[0.77]	[0.81]	[0.97]	[0.96]	[0.81]	[0.83]
Education years for household head	0.0043	0.004	0.0025	0.002	0.0032	0.0028	0.0017	0.0013	0.004	0.0034	0.0022	0.0015	0.0031	0.0027	0.0015	0.001
	[0.42]	[0.39]	[0.23]	[0.19]	[0.31]	[0.27]	[0.16]	[0.12]	[0.39]	[0.34]	[0.20]	[0.13]	[0.30]	[0.26]	[0.14]	[0.09]
Number of household members	-0.0097	-0.0101	-0.0133	-0.0138	-0.0114	-0.0122	-0.0151	-0.0161	-0.0112	-0.0121	-0.0149	-0.0161	-0.0114	-0.0123	-0.0148	-0.0159
	[-0.59]	[-0.63]	[-0.91]	[-0.98]	[-0.69]	[-0.76]	[-1.02]	[-1.13]	[-0.68]	[-0.75]	[-1.01]	[-1.14]	[-0.69]	[-0.76]	[-0.99]	[-1.11]
Province Dummy (Prey Veng)	0.1537	0.1531	0.1637	0.1673	0.1166	0.1209	0.1305	0.1411	0.1291	0.1233	0.1377	0.136	0.1016	0.1026	0.1093	0.115
	[5.47]***	[4.85]***	[6.73]***	[6.96]***	[3.05]**	[2.55]**	[3.80]***	[3.27]***	[3.67]***	[2.98]**	[4.55]***	[4.07]***	[2.70]**	[2.20]**	[3.71]***	[3.11]***
Province Dummy (Pursat)	0.1445	0.1505	0.1777	0.1854	0.1794	0.1873	0.205	0.213	0.1697	0.1832	0.2064	0.2244	0.1864	0.1963	0.2212	0.235
	[3.32]***	[2.71]**	[3.61]***	[2.94]**	[5.69]***	[4.22]***	[4.40]***	[3.47]***	[5.39]***	[3.83]***	[5.41]***	[3.85]***	[6.31]***	[4.42]***	[5.74]***	[4.18]***
Province Dummy (Takeo	0.1691	0.1728	0.1745	0.1744	0.2031	0.2162	0.2066	0.2158	0.1496	0.149	0.1542	0.1488	0.1663	0.17	0.1452	0.1356
	[2.94]**	[3.06]***	[3.06]***	[3.08]***	[3.54]***	[3.41]***	[3.72]***	[3.63]***	[2.76]**	[2.70]**	[2.94]**	[2.83]**	[2.97]**	[2.71]**	[2.12]*	[2.10]*
Constant	0.6219	0.6583	0.7175	0.7656	-0.3481	-0.1604	-0.0706	0.1847	0.6471	0.7037	0.7353	0.8065	-0.3041	-0.0905	-0.0004	0.314
	[1.79]*	[1.93]*	[1.77]	[1.92]*	[-0.47]	[-0.20]	[-0.10]	[0.24]	[1.88]*	[2.13]*	[1.81]*	[2.08]*	[-0.39]	[-0.11]	[-0.00]	[0.36]
R-squared	0.0639	0.0664	0.0691	0.0732	0.0707	0.0747	0.0747	0.0802	0.0697	0.0746	0.0759	0.0834	0.0716	0.076	0.0769	0.0839
Adj-R-squared	0.0116	0.0041	0.0106	0.0045	0.0088	0.0027	0.0062	0.0015	0.0128	0.0078	0.0127	0.0103	0.0046	-0.001	0.0032	0.0002
Observation	209	209	204	204	209	209	204	204	209	209	204	204	209	209	204	204

Standard error is clustered at the village level and the estimated t-values are in parentheses. *, **, *** are indicated to show *P-value* to reject null hypothesis with P< 0.1, P< 0.05, p<0.01, respectively.

Table 7: Estimation result for number of participations of ordinary farmers

Dependent variable	①Base model				②Base model + Key farmer characteristics				③Base model + Interaction term				④All			
Number of Participations	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16
Altruism (log)	0.1558	0.1644	0.1696	0.1747	0.1397	0.1477	0.1525	0.157	0.1407	0.1486	0.1521	0.1572	0.1059	0.1145	0.1157	0.1211
	[2.96]**	[2.82]**	[2.70]**	[2.64]**	[2.71]**	[2.70]**	[2.75]**	[2.70]**	[4.98]***	[4.75]***	[5.04]***	[4.75]***	[2.78]**	[2.95]**	[3.09]***	[3.12]***
Reputational concern (log)	-0.0037	-0.0018	0.0006	0	-0.0236	-0.0241	-0.0223	-0.0242	-0.0196	-0.0167	-0.0182	-0.0173	-0.0233	-0.0216	-0.025	-0.024
	[-0.08]	[-0.04]	[0.01]	[-0.00]	[-0.47]	[-0.44]	[-0.45]	[-0.46]	[-0.45]	[-0.38]	[-0.39]	[-0.38]	[-0.60]	[-0.50]	[-0.66]	[-0.59]
Years of Education of key farmer					0.0357	0.0402	0.0488	0.0503					-0.1297	-0.1239	-0.1497	-0.1478
					[0.71]	[0.77]	[0.85]	[0.87]					[-1.87]*	[-1.67]	[-1.94]*	[-1.81]*
Log income of key farmer					0.5225	0.5277	0.5258	0.5388					0.5545	0.5449	0.5624	0.5515
					[1.10]	[1.04]	[1.14]	[1.08]					[1.04]	[0.96]	[1.07]	[0.98]
Interaction term of altruism and Reputational concern									0.0161	0.0181	0.0194	0.0207	0.0489	0.0491	0.0565	0.0571
									[3.70]***	[2.47]**	[4.32]***	[2.72]**	[3.70]***	[3.16]***	[4.11]***	[3.43]***
Physical distance to key farmer		0.0696		0.1247		0.1147		0.1659		-0.0683		-0.0399		-0.0094		-0.0277
		[0.10]		[0.19]		[0.15]		[0.22]		[-0.10]		[-0.06]		[-0.01]		[-0.04]
Consultation to key farmer			1.5674	1.5329			1.5977	1.5667			1.62	1.5726			1.6686	1.6238
			[2.63]**	[2.55]**			[2.64]**	[2.56]**			[2.76]**	[2.62]**			[2.77]**	[2.64]**
Number of times of rice growing	-0.3016	-0.3667	-0.3121	-0.3661	-0.2385	-0.3117	-0.2599	-0.3187	-0.3295	-0.3842	-0.3479	-0.3845	-0.2105	-0.2713	-0.2092	-0.2472
	[-0.76]	[-0.85]	[-0.76]	[-0.82]	[-0.60]	[-0.73]	[-0.63]	[-0.71]	[-0.85]	[-0.92]	[-0.86]	[-0.88]	[-0.54]	[-0.67]	[-0.51]	[-0.58]
Log of off-farm income for household	-0.112	-0.1094	-0.115	-0.1122	-0.1145	-0.1106	-0.1159	-0.1123	-0.1115	-0.111	-0.1146	-0.1144	-0.1349	-0.1327	-0.1425	-0.1418
	[-1.09]	[-1.12]	[-1.10]	[-1.11]	[-1.09]	[-1.12]	[-1.08]	[-1.10]	[-1.08]	[-1.14]	[-1.09]	[-1.14]	[-1.23]	[-1.29]	[-1.26]	[-1.31]
Sex of household head	0.6948	0.6322	0.8403	0.7819	0.741	0.6703	0.8755	0.8151	0.6577	0.5964	0.7999	0.7432	0.8358	0.7695	0.9695	0.9132
	[1.00]	[0.91]	[1.18]	[1.14]	[1.06]	[0.97]	[1.22]	[1.18]	[0.94]	[0.85]	[1.11]	[1.07]	[1.14]	[1.07]	[1.29]	[1.27]
Age of household head	-0.0088	-0.01	-0.0078	-0.0092	-0.0076	-0.0089	-0.0065	-0.0078	-0.0091	-0.0102	-0.008	-0.0093	-0.0089	-0.0101	-0.0076	-0.0088
	[-0.42]	[-0.47]	[-0.36]	[-0.41]	[-0.37]	[-0.42]	[-0.30]	[-0.35]	[-0.43]	[-0.48]	[-0.36]	[-0.41]	[-0.44]	[-0.49]	[-0.35]	[-0.40]
Education years for household head	-0.0726	-0.0765	-0.0658	-0.0691	-0.0811	-0.085	-0.0741	-0.0775	-0.0746	-0.0792	-0.0678	-0.0722	-0.0828	-0.0869	-0.0777	-0.0816
	[-1.08]	[-1.11]	[-0.93]	[-0.94]	[-1.24]	[-1.27]	[-1.06]	[-1.07]	[-1.11]	[-1.15]	[-0.95]	[-0.98]	[-1.26]	[-1.30]	[-1.11]	[-1.13]
Number of household members	0.1096	0.1073	0.0931	0.0947	0.1095	0.1069	0.0912	0.093	0.1013	0.0971	0.0828	0.0826	0.109	0.1053	0.0955	0.0952
	[0.98]	[1.02]	[0.83]	[0.90]	[0.96]	[1.02]	[0.80]	[0.88]	[0.91]	[0.95]	[0.75]	[0.81]	[0.94]	[0.99]	[0.82]	[0.88]
Province Dummy (Prey Veng)	1.2466	1.203	1.1825	1.1464	0.9057	0.8558	0.8305	0.7828	1.1099	1.051	1.0193	0.9806	0.5307	0.4917	0.4629	0.4363
	[2.08]*	[1.92]*	[1.98]*	[1.79]*	[1.63]	[1.45]	[1.43]	[1.24]	[1.76]	[1.63]	[1.62]	[1.50]	[1.05]	[0.90]	[0.98]	[0.84]
Province Dummy (Pursat)	-0.0409	0.0385	0.1067	0.1529	0.1392	0.2257	0.3037	0.3529	0.0996	0.2055	0.2867	0.3599	0.3141	0.4044	0.5821	0.6444
	[-0.09]	[0.09]	[0.20]	[0.28]	[0.30]	[0.48]	[0.56]	[0.65]	[0.26]	[0.53]	[0.59]	[0.70]	[1.37]	[1.53]	[1.89]*	[1.78]*
Province Dummy (Takeo	-0.5781	-0.436	-0.672	-0.5677	-0.6312	-0.4715	-0.6799	-0.5716	-0.6863	-0.5576	-0.7991	-0.7036	-1.5529	-1.3935	-1.7389	-1.635
	[-1.01]	[-0.72]	[-1.21]	[-0.96]	[-1.05]	[-0.77]	[-1.15]	[-0.93]	[-1.36]	[-1.01]	[-1.68]	[-1.34]	[-2.24]**	[-1.88]*	[-2.45]**	[-2.15]*
Constant	5.2696	5.507	3.8157	4.0103	-3.8909	-3.7921	-5.5314	-5.5879	5.4097	5.7387	3.9275	4.227	-2.7894	-2.3966	-4.32	-3.8746
	[2.11]*	[2.18]*	[1.35]	[1.38]	[-0.47]	[-0.43]	[-0.67]	[-0.62]	[2.20]**	[2.33]**	[1.40]	[1.48]	[-0.30]	[-0.24]	[-0.45]	[-0.37]
R-squared	0.094	0.0977	0.1112	0.1133	0.0966	0.1004	0.114	0.1162	0.0971	0.1014	0.1157	0.1181	0.1056	0.1094	0.1251	0.1271
Adj-R-squared	0.0434	0.0376	0.0554	0.0476	0.0363	0.0305	0.0484	0.0406	0.0418	0.0366	0.0552	0.0477	0.0411	0.0352	0.0552	0.0474
Observation	209	209	204	204	209	209	204	204	209	209	204	204	209	209	204	204

Standard error is clustered at the village level and the estimated t-values are in parentheses. *, **, *** are indicated to show *P-value* to reject null hypothesis with P< 0.1, P< 0.05, p<0.01, respectively.

Table 8: Estimation result by type I Tobit model

Dependent variable	①Base model				②Base model + Key farmer characteristics				③Base model + Interaction term				④All			
Number of Participations	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16
Altruism (log)	0.2842	0.2919	0.3058	0.3108	0.2587	0.2664	0.2809	0.286	0.2579	0.2634	0.2762	0.2795	0.2155	0.2231	0.2313	0.2359
	[3.05]***	[2.91]***	[2.97]***	[2.85]***	[3.59]***	[3.54]***	[3.61]***	[3.50]***	[5.92]***	[5.71]***	[6.12]***	[5.81]***	[4.14]***	[4.24]***	[4.59]***	[4.51]***
Reputational concern (log)	0.0263	0.0301	0.0212	0.0232	-0.0137	-0.0126	-0.017	-0.0164	-0.0039	0.0012	-0.0124	-0.0092	-0.016	-0.0125	-0.0237	-0.0197
	[0.46]	[0.50]	[0.36]	[0.39]	[-0.21]	[-0.18]	[-0.26]	[-0.24]	[-0.08]	[0.02]	[-0.22]	[-0.16]	[-0.31]	[-0.22]	[-0.47]	[-0.37]
Years of Education of key farmer					0.0905	0.1005	0.0954	0.1015					-0.1111	-0.1026	-0.1618	-0.1637
					[1.42]	[1.52]	[1.26]	[1.33]					[-1.28]	[-1.14]	[-1.64]	[-1.68]*
Log income of key farmer					0.7148	0.7083	0.6574	0.6472					0.7741	0.7506	0.725	0.6848
					[1.14]	[1.08]	[1.11]	[1.04]					[1.12]	[1.04]	[1.08]	[0.97]
Interaction term of altruism and Reputational concern									0.0293	0.033	0.033	0.0366	0.0613	0.0623	0.0747	0.0777
									[3.92]***	[3.13]***	[4.30]***	[3.30]***	[3.53]***	[3.27]***	[4.14]***	[3.99]***
Physical distance to key farmer		-0.0461		-0.0684		-0.046		-0.0614		-0.2802		-0.3393		-0.1782		-0.2978
		[-0.06]		[-0.09]		[-0.06]		[-0.08]		[-0.38]		[-0.46]		[-0.22]		[-0.37]
Consultation to key farmer			1.5225	1.4766			1.5459	1.4977			1.5918	1.5284			1.6604	1.602
			[1.68]*	[1.64]			[1.71]*	[1.66]*			[1.76]*	[1.69]*			[1.82]*	[1.75]*
Number of times of rice growing	-0.4784	-0.5415	-0.4784	-0.514	-0.4256	-0.5016	-0.4453	-0.4921	-0.5348	-0.5834	-0.5442	-0.557	-0.3939	-0.4565	-0.3795	-0.3997
	[-0.79]	[-0.86]	[-0.79]	[-0.82]	[-0.70]	[-0.80]	[-0.72]	[-0.77]	[-0.90]	[-0.96]	[-0.90]	[-0.90]	[-0.66]	[-0.76]	[-0.62]	[-0.66]
Log of off-farm income for household	-0.1622	-0.1599	-0.1635	-0.1629	-0.1607	-0.1568	-0.16	-0.1582	-0.1608	-0.1618	-0.1622	-0.1657	-0.1866	-0.1848	-0.1962	-0.1989
	[-1.16]	[-1.20]	[-1.19]	[-1.23]	[-1.11]	[-1.15]	[-1.12]	[-1.16]	[-1.14]	[-1.22]	[-1.17]	[-1.26]	[-1.26]	[-1.33]	[-1.32]	[-1.41]
Sex of household head	1.168	1.0848	1.3109	1.2418	1.1952	1.0979	1.3387	1.2589	1.1629	1.0781	1.3099	1.2352	1.3273	1.2339	1.4708	1.3955
	[0.96]	[0.90]	[1.08]	[1.05]	[1.00]	[0.93]	[1.12]	[1.08]	[0.95]	[0.88]	[1.07]	[1.03]	[1.08]	[1.02]	[1.20]	[1.17]
Age of household head	-0.0009	-0.0023	-0.0015	-0.0029	0.0011	-0.0003	0.0006	-0.0009	-0.0009	-0.0022	-0.0013	-0.0025	0.0002	-0.0011	-0.0001	-0.0013
	[-0.03]	[-0.07]	[-0.05]	[-0.09]	[0.04]	[-0.01]	[0.02]	[-0.03]	[-0.03]	[-0.07]	[-0.04]	[-0.08]	[0.01]	[-0.04]	[-0.00]	[-0.04]
Education years for household head	-0.0603	-0.0669	-0.0575	-0.0635	-0.0724	-0.0797	-0.068	-0.0744	-0.0636	-0.072	-0.0607	-0.0691	-0.0729	-0.0803	-0.0706	-0.0779
	[-0.62]	[-0.67]	[-0.55]	[-0.59]	[-0.75]	[-0.80]	[-0.65]	[-0.70]	[-0.65]	[-0.72]	[-0.58]	[-0.64]	[-0.76]	[-0.82]	[-0.69]	[-0.74]
Number of household members	0.0893	0.0823	0.0572	0.0548	0.0838	0.0747	0.0495	0.0458	0.0752	0.0636	0.0408	0.0337	0.0845	0.0738	0.0571	0.0505
	[0.57]	[0.55]	[0.38]	[0.39]	[0.54]	[0.51]	[0.33]	[0.33]	[0.49]	[0.44]	[0.28]	[0.24]	[0.53]	[0.50]	[0.37]	[0.35]
Constant	4.1768	4.5424	2.8964	3.2319	-8.6792	-8.2572	-9.0448	-8.562	4.3488	4.8804	3.0154	3.5422	-7.7164	-6.9307	-7.8806	-6.6944
	[1.21]	[1.32]	[0.74]	[0.82]	[-0.82]	[-0.75]	[-0.87]	[-0.79]	[1.29]	[1.47]	[0.78]	[0.92]	[-0.65]	[-0.56]	[-0.66]	[-0.54]
sigma	4.6319	4.6228	4.6129	4.6084	4.6254	4.616	4.6061	4.6013	4.6217	4.611	4.5989	4.5934	4.6009	4.5916	4.5745	4.5696
	[11.11]***	[11.14]***	[10.59]***	[10.67]***	[11.16]***	[11.20]***	[10.60]***	[10.70]***	[11.10]***	[11.07]***	[10.55]***	[10.57]***	[11.22]***	[11.21]***	[10.61]***	[10.63]***
Observation	209	209	204	204	209	209	204	204	209	209	204	204	209	209	204	204

Standard error is clustered at the village level and the estimated t-values are in parentheses. *, **, *** are indicated to show *P-value* to reject null hypothesis with P< 0.1, P< 0.05, p<0.01, respectively. All regressions include Province fixed effect.

Table 9: Estimation result by general altruism and participation by linear probability model

Dependent variable	①Base model				②Base model + Key farmer characteristics			
Participation	1	2	3	4	5	6	7	8
Altruism (log)	0.0225	0.0232	0.0213	0.0222	0.0225	0.0246	0.0223	0.0247
	[4.04]***	[3.96]***	[3.58]***	[3.49]***	[5.11]***	[5.82]***	[4.56]***	[5.49]***
Years of education of key farmer					0.0138	0.0156	0.012	0.0135
					[2.52]**	[2.53]**	[1.88]*	[2.10]*
Log income of key farmer					-0.0196	-0.0366	-0.03	-0.052
					[-0.32]	[-0.57]	[-0.49]	[-0.82]
Physical distance to key farmer		-0.0461		-0.0763		-0.0843		-0.1097
		[-0.70]		[-1.14]		[-1.37]		[-1.83]*
Consultation to key farmer			-0.0707	-0.0781			-0.063	-0.0732
			[-0.57]	[-0.65]			[-0.51]	[-0.61]
Number of times of rice growing	0.0056	0.0104	0.0086	0.0193	-0.0075	-0.0021	-0.0059	0.0049
	[0.11]	[0.22]	[0.17]	[0.44]	[-0.14]	[-0.04]	[-0.11]	[0.10]
Log of off-farm income for household	-0.0149	-0.0156	-0.0146	-0.0159	-0.0131	-0.0141	-0.0128	-0.0142
	[-0.91]	[-0.97]	[-0.90]	[-0.98]	[-0.80]	[-0.89]	[-0.78]	[-0.89]
Sex of household head	0.1122	0.113	0.1109	0.113	0.0963	0.0938	0.098	0.0962
	[0.84]	[0.83]	[0.84]	[0.85]	[0.75]	[0.71]	[0.77]	[0.74]
Age of household head	0.0023	0.0023	0.0018	0.0019	0.0023	0.0023	0.0017	0.0018
	[0.78]	[0.80]	[0.60]	[0.65]	[0.77]	[0.77]	[0.60]	[0.63]
Education years for household head	0.001	0.0005	-0.0007	-0.0012	0.0014	0.0009	0	-0.0006
	[0.09]	[0.05]	[-0.06]	[-0.11]	[0.14]	[0.08]	[0.00]	[-0.06]
Number of household members	-0.0069	-0.0072	-0.0094	-0.0099	-0.0095	-0.0107	-0.0123	-0.0137
	[-0.42]	[-0.44]	[-0.62]	[-0.68]	[-0.57]	[-0.66]	[-0.81]	[-0.95]
Province Dummy (Prey Veng)	0.0804	0.0778	0.0961	0.0975	0.0911	0.0948	0.1061	0.1172
	[1.74]	[1.72]	[2.06]*	[2.29]**	[2.43]**	[2.88]**	[2.29]**	[2.94]**
Province Dummy (Pursat)	0.0887	0.094	0.1113	0.1195	0.0975	0.1041	0.1122	0.1194
	[1.53]	[1.37]	[1.71]	[1.56]	[2.54]**	[2.22]**	[2.33]**	[2.12]*
Province Dummy (Takeo)	0.0419	0.0382	0.0538	0.0461	0.1149	0.1212	0.1169	0.1195
	[0.59]	[0.57]	[0.71]	[0.64]	[1.60]	[1.62]	[1.54]	[1.63]
Constant	0.6632	0.6929	0.7579	0.801	0.895	1.2252	1.1757	1.6061
	[1.92]*	[2.03]*	[1.85]*	[1.99]*	[0.86]	[1.13]	[1.12]	[1.49]
R-squared	0.0563	0.0579	0.0588	0.0624	0.0664	0.0713	0.0673	0.0744
Adj-R-squared	0.0086	0.0002	0.0049	-0.0017	0.0092	0.0043	0.0034	0.0006
Observation	209	209	204	204	209	209	204	204

Standard error is clustered at the village level and the estimated t-values are in parentheses. *, **, *** are indicated to show P-value to reject null hypothesis with P< 0.1, P< 0.05, p<0.01, respectively.

Table 10: Estimation result by general altruism and participation by linear probability model

Dependent variable	①Base model				②Base model + Key farmer characteristics			
Number of Participations	1	2	3	4	5	6	7	8
Altruism (log)	0.1048	0.1096	0.1097	0.1117	0.0981	0.1043	0.1008	0.1036
	[2.71]**	[2.53]**	[2.66]**	[2.54]**	[1.91]*	[1.78]	[1.95]*	[1.74]
Years of education of key farmer					0.0094	0.0154	0.0256	0.0279
					[0.17]	[0.27]	[0.39]	[0.41]
Log income of key farmer					0.1	0.0718	0.1192	0.1094
					[0.15]	[0.10]	[0.18]	[0.15]
Physical distance to key farmer		0.0009		0.0715		-0.0132		0.0496
		[0.00]		[0.11]		[-0.02]		[0.07]
Consultation to key farmer			1.5809	1.5463			1.597	1.5609
			[2.57]**	[2.49]**			[2.57]**	[2.45]**
Number of times of rice growing	-0.0956	-0.1372	-0.0939	-0.1309	-0.0912	-0.1394	-0.1024	-0.14
	[-0.27]	[-0.37]	[-0.25]	[-0.33]	[-0.25]	[-0.37]	[-0.27]	[-0.35]
Log of off-farm income for household	-0.1238	-0.1227	-0.1271	-0.1255	-0.1236	-0.1218	-0.1251	-0.1234
	[-1.17]	[-1.21]	[-1.17]	[-1.19]	[-1.15]	[-1.19]	[-1.15]	[-1.17]
Sex of household head	0.794	0.741	0.9376	0.8889	0.7985	0.7361	0.9335	0.8816
	[1.10]	[1.04]	[1.26]	[1.24]	[1.11]	[1.04]	[1.26]	[1.23]
Age of household head	-0.0119	-0.0131	-0.0109	-0.0121	-0.0116	-0.0129	-0.0105	-0.0118
	[-0.58]	[-0.63]	[-0.51]	[-0.55]	[-0.59]	[-0.64]	[-0.50]	[-0.54]
Education years for household head	-0.0815	-0.0862	-0.0757	-0.0792	-0.0824	-0.0868	-0.0762	-0.0797
	[-1.24]	[-1.27]	[-1.08]	[-1.08]	[-1.28]	[-1.31]	[-1.10]	[-1.11]
Number of household members	0.123	0.1217	0.1119	0.1137	0.1231	0.1202	0.109	0.1101
	[1.08]	[1.12]	[0.97]	[1.05]	[1.07]	[1.14]	[0.94]	[1.03]
Province Dummy (Prey Veng)	0.9425	0.8865	0.8553	0.8184	0.8959	0.8529	0.7923	0.759
	[1.47]	[1.36]	[1.34]	[1.21]	[1.32]	[1.19]	[1.11]	[0.99]
Province Dummy (Pursat)	-0.4936	-0.4334	-0.3763	-0.3452	-0.4561	-0.3957	-0.3221	-0.289
	[-1.33]	[-1.07]	[-0.83]	[-0.70]	[-1.15]	[-0.94]	[-0.69]	[-0.60]
Province Dummy (Takeo	-0.986	-0.8941	-1.138	-1.061	-0.964	-0.8362	-1.0464	-0.9574
	[-2.16]*	[-1.74]	[-2.40]**	[-2.05]*	[-2.28]**	[-1.84]*	[-2.47]**	[-2.05]*
Constant	5.4448	5.7017	3.9682	4.1655	3.6592	4.3636	1.7184	2.082
	[2.18]*	[2.26]**	[1.40]	[1.43]	[0.32]	[0.35]	[0.14]	[0.16]
R-squared	0.0927	0.096	0.1084	0.11	0.0928	0.0961	0.1088	0.1105
Adj-R-squared	0.0469	0.0406	0.0573	0.0491	0.0372	0.0309	0.0478	0.0395
Observation	209	209	204	204	209	209	204	204

Standard error is clustered at the village level and the estimated t-values are in parentheses. *, **, *** are indicated to show P-value to reject null hypothesis with P< 0.1, P< 0.05, p<0.01, respectively.

Figure 1: Variation of beneficiaries' number of participations in the training sessions within village