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Cooperative Behavior in Farmer Clubs: Experimental Evidence from Malawi

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FIRST DRAFT – NOT FOR CITATION

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Abstract

Farmer clubs play an important role in improving the lives of millions of farmers in developing countries as they can resolve critical market failures, ranging from providing access to output markets and club-based input credit to sharing technology and marketing information. The efficacy of farmer clubs, however, depends on successful collaboration between members and their ability to overcome free-riding. In this study, we conducted a public goods game among farmer clubs in Malawi. In this game, club members were asked to divide 400 Malawian kwacha between an individual account and a common account. At the end of the game, the funds in the common account were multiplied by two and used by the club to provide a public good of their choice. Using the amount contributed into the common account as a measure of cooperative behavior, we find that most club members display some level of cooperative behavior, and that the extent of this cooperative behavior critically depends on an individual's relative status within the club. Individuals with a higher status cooperate less compared to individuals with a lower status. In addition, women appear to be less cooperative compared to men. We show that these results are consistent with the predictions of a Voluntary Contribution Nash Equilibrium in which club members are uncertain about each other's valuations and expect a bargaining process (as opposed to democratic process) to resolve these uncertainties and provide a resolution as to which public good the club selects at the end of the game.

JEL Codes: O1; Q1;H4;

Keywords: Farmer clubs, Malawi, Public Goods Game

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1. Introduction

Farmer clubs[4] play an important and varied role in improving the lives of millions of farmers across the developing world and serve as the cornerstone of numerous Non-Governmental Organization (NGO) and government extension activities. Farmer clubs have the potential to solve a number of critical market failures, including facilitating output market access through bargaining and sharing transportation fixed costs, allowing group-based access to input credit and forming a base to share information about new production technologies or markets.

The efficacy of farmer clubs, however, crucially depends on successful collaboration between members in order to (at least partially) overcome the traditional free-riding problem. For instance, the success of a joint credit application depends on the extent to which farmers can reduce moral hazard within the club. Reducing moral hazard requires effective monitoring of fellow club members, yet monitoring is a public good and subject to free-riding. Demonstration plots are a second example of the importance of collaboration within farmer groups. A demonstration plot is a defined area within the village where new crops or technologies are exhibited. Demonstration plots are often introduced by extension agents, but day-to-day management is commonly left to farmer clubs. A successful demonstration plot can serve as a source of practical, local and timely information about agricultural technologies. However, in practice, many demonstration plots do not succeed: they are abandonded midway or perform poorly in terms of yields, generating a cascade of bad publicity about potentially yield enhancing and profit increasing agricultural technologies. For instance, Kondylis and Mueller (2012) find only small effects of demonstration plots on knowledge and adoption of new agricultural practices in Mozambique.

Despite the vast literature on free-riding in groups, both laboratory and field setttings free-riding in farmer clubs has been largely unexamined. In this study, we take a first step towards understanding farmer club dynamics by conducting and analyzing a public goods game with farmer clubs in Malawi.

We worked with an NGO, Clinton Development Initiatives (henceforward CDI), to identify 87 farmer clubs in Malawi's Kasungu and Dowa districts. Each farmer club has between 8 and 20 members, and was formed upon invitation by the NGO for the purpose of the NGO's project. The clubs will be eligible to receive credit, inputs and guidance to run a demonstration plot from the NGO in the coming years. We collected baseline data for all club members in Fall 2014, including age, gender, education and land owned, as well as their knowledge of the amount of land owned of one (other) randomly selected club member. We use these data to construct measures of heterogeneity and knowledge in our analysis. We then conducted a public goods game. In this game, each club member was asked to divide 400 Malawian Kwacha (equivalent to about one USD) into two envelopes. The money they placed in one envelope, labelled the "individual account" was theirs to keep while the money placed in the second envelope, labelled the "common account" was multiplied by two and shared with all the other members of the club.

[4] We will refer to farmer groups, cooperatives and clubs to a generic name of farmer clubs.

The individual's decision was made in private, as to avoid social pressures, and recorded by the enumerator in a confidential manner.

While the Nash Equilibrium would result in each member keeping the full one USD to themselves, a Pareto superior outcome would be for all individuals to contribute everything to the common pot. Results from experiments in a laboratory setting show that most individuals contribute at least something to the common pot (see, among others Ledyard 1995 for an overview). However, field settings do not always agree. For instance, Stoop et al. (2012) find that fishermen in the Netherlands in a framed experiment do not behave in cooperative manner. In our experiment, we find that the farmer club members do cooperate with each other, at least to a certain extent: the average contribution to the common pot is 170 Malawian Kwacha, which is about 40% of the initial individual endownment. Only 5% of club members contribute nothing to the common pot.

Unlike in most (framed) public goods experiment, where the common pot is returned – in equal shares to the members – we allowed the club members to discuss what the money was to be used for both before and after the game took place. While we did not follow up with the club members on the actual implementation of this decision, it is notable that all of the clubs mentioned some type of public goods use of the common pot, ranging from payment for expenditures associated with communication and transportation to the creation of a a ROSCA style club account.

We expected that allowing for such a discussion would affect the contribitions to the common pot. In particular, consistent with the predictions of a traditional Voluntary Contribution Equilibrium (henceforward VCE) in which individuals are asked to contribute to a public good, we find that (a) the number of club members negatively correlates with the contribution to the common pot, (b) measures of wealth, such as landholding, positively correlate with the contribution to the common pot, and (c) some measures (in particular, land owned) of within-club heterogeneity positively correlate, albeit weakly, with the total (club-level) contributions to the public good (see, among others, Kolle et al. 2015 for a laboratory experimental investigation into the role of heterogeneity).[5]

However, unlike a traditional VCE set-up, which operates under full information assumptions, members of the club might be uncertain about eachothers' preferences, and this uncertainty might affect contributions to the common pot if individuals are risk-averse. In particular, note that in a two-person public goods game, if player 1 were to increase (decrease) her contribution to the public good, player 2 would respond by decreasing (increasing) hers. Introducing a mean-preserving spread into player 2's preferences would result in player 1 increasing her contribution as a decrease in player 2's contribution might outweigh an equivalent-sized increase in player 1's contribution (see Sandler et al. 1989 for a theoretical expositon on the exact conditions under which this is true). Consistent with this theory, we find that a decrease in knowledge about the other club members is associated with an increase in contribution to the common pot.

In addition, in this particular setting, uncertainty about eachothers' preferences also results in uncertainty regarding the nature of the public good selected by the club. How this would affect someone's

[5] For an introduction into VCE, see the seminal paper of Bergstorm et al. (1986).

contribution might depend on the decision-making process she expects the club to use. If, for example, I expect a democratic, i.e., median voter based, decision-making process, then any increase in my (perceived) distance to the median voter (in terms of preferences) would decrease my contribution. However, if I expect decisions to be made through a bargaining process, an increase in the (perceived) difference between my contribution and the median voter's (again in terms of preferences) would increase my contribution.

The data does not support either decision-making process: we find that individuals with attributes (in terms of age, education and wealth) under the median contribute more, while individuals with attributes above the median contribute less, suggesting a perverse bargaining model in wich individuals under the median exert more bargaining power. As women, on average, contribute less to the common pot compared to men, we find this perverse bargaining model quite unlikely and explore other interprations in the concluding discussion.

The rest of this article is structured as follows. In the next section, we review the relevant literature. Section 4 gives an overview of the data collected in the experiment. Section 4 outlines the econometric specification and Section 5 discusses the results. Section 6 concludes with a discussion.

2. Literature review

[FORTHCOMING]

3. Data

In this section, we provide an overview of the data collection process, present the details of the public goods game, and provide some descriptive statistics as to introduce the sample.

3.1. Data collected

In the Fall of 2014, together with the NGO CDI, we selected two EPAs (Extension Planning Areas) in Malawi: Chibvala EPA in Dowa district and Mtumthama EPA in Kasungu district. The total number of villages in these two EPAs amounts to 360, with just 303 villages with more than 50 households. We randomly selected 250 villages from these 303 villages of adequate size, and divide this set – again randomly – into two groups: treatment and control. The treatment villages were asked to form farmer clubs of ten to twenty members, and eligible to receive several of the Anchor Farm Program Interventions in the 2014-15 and following agricultural seasons.[6] In this article, we focus on treatment villages only. Among the 125 treatment villages, 87 formed farmer clubs.

[6] For an introduction to this program as well as our evaluation of this program: see https://sites.google.com/site/isfmmalawi/

In each village, we selected ten farmers. In the treatment villages with clubs, this sample consisted of five randomly selected club members, and five non-club members, also randomly selected. We collected village level, agronomic and baseline household data among all 1250 farmers in the treatment villages. The household data includes information on household composition, landholdings, and agricultural production by plot focusing on the 2013-14 rainy season[7], marketing of crops, assets, social networks, past adoption practices and experimentation, time preferences and beliefs regarding yields.

In this article, we restrict ourselves to using the baseline household data from club members only and use the following variables: (i) total asset values (in Malawian Kwacha), (ii) per capita rainy season agricultural income pertaining to the 2013-14 season (in Malawian Kwacha)[8] and (iii) measures of social connections to the club members. The latter are based on the social network module of the household questionnaire in which we asked the respondent a series of questions regarding their relationship to every club member in that village. In particular we asked: "Do you know who this person is?" If the respondent replied "yes", we followed up with: (i) "Have you asked this person for advice about your farm in the past one year?" (ii) "Could you approach this person if you had a question about farming?" and (iii) "Would you trust this person to look after a valuable item for you?".

3.2. Experimental design

We invited all club members to a central location in the village and recorded, in private, the age, gender, education level and acreage of land owned, as well as their knowledge of the amount of land owned of one (other) randomly selected club member.

We then proceeded to explain the game to all members present. The details of the protocol are recorded in the Appendix. In this game, each club member was asked to divide 400 Malawian Kwacha (equivalent to about one USD) into two envelopes. The money placed in an envelope labelled "individual pot" was theirs to keep while the money placed in an envelope labelled "common pot" was multiplied by two and shared with all the other members of the club. The decision as to how much to contribute to each pot was made in private, and recorded, in a confidential manner by the enumerator only. In addition, we, the enumerators, also contributed a – to the game members – unknown amount to the common pot, so that no-one could derive the contributions of other members from the total amount in the common pot. Once

[7] Farmers in Malawi distinguish between plots used for the rainy season, called Munda plots and Dimba plots, plots used during the dry, summer season. The latter are often located close to the river and used to produce vegetables for home consumption using irrigation. As the dry season of 2013 was too long ago to recall at the time of our interview – in Fall 2014 – we decided to focus on activities on the Munda plots only, which represent the main source of agricultural income.

[8] We estimate household agricultural revenues for the 2013-14 rainy season as follows:

$$R_i = \sum_{for\ all\ k} Harvest_{i,k} * P_{i,k}$$

Where i refers to the household and k refers to the crop. Thus revenue equals the sum of revenues from each crop, where revenue of a crop is defined as the harvest amount multiplied by the village-level crop-specific price, meaning we value both sold and non-sold units. We then proceed and estimate the household costs for the 2013-14 rainy season by adding, for each plot, the various paid out costs as reported by the respondent. These costs can include costs of hired labor, pesticides, fertilizers and seeds. Note that we did not impute an opportunity cost for the costs which were not paid out, such as own family labor.

each club member made their decision, the enumerator collected all "common pot" envelopes, added his/her own envelop, mixed up the envelopes, and opened them. He/she then counted the total amount, added an equivalent amount and returned the full amount to the club.

Before the club members made their decisions, but after the game was explained, the club members were given the opportuninity to discuss, among themselves, what the money in the common pot could be used for. After the club members made their decision, and the total amount in the common pot was revealed, the club members were again asked to discuss what the common pot could be used for, and to make a decision – as a group – on the matter. Even though we did not follow up on the implementation of this decision, we did record this prospective use of the common funds.

3.3. Descriptive statistics

Table 1 introduces the sample. The average club member is 48 years and has received 5.5 years of education. About half of the club members were female. The average amount of land owned is about five acres. Only 7% of the game members had their spouse present as a member of the group and therefore a participant in the game. The total asset value is estimated at, on average, about 5,000,000 MK – which was equivalent to 12,500 USD at the time of the survey. The per capita (rainy) season agricultural income is estimated at, on average, 40,000 MK – or 100 USD. Note very large standard deviations acreage of land owned and per-capita income as well as the discrepancy between the average and the median, revealing distributions which are skewed to the right.

Table 1 about here

Table 2 presents some club-level descriptive statistics. The number of club members ranges from 8 to 20; the average number of club members is 16. The number of club members present for the game ranges from 6 to 20; the average number of present club members is 12.

Table 2 about here

Figure 1 presents the histogram of individual contributions to the common pot. The average contribution to the common pot is 170 MK (standard deviation is 120 MK), the median is 150 MK, the minimum is 0 MK and the maximum is 400 MK. It is notable that just over 5% of the club members contributed nothing to the common pot, while well over 10% contributed the full 400 KW to the common pot. These results indicate that members of the club, in general, behave in a cooperative manner.

Figure 1 about here

We recorded the intended use of the common pot at the end of the game: 20% of clubs mention they'll use the funds to finance expenditures such as transportation to field days, hosting of extension agents, communication with extension agents and purchasing stationary. Another 14% of clubs stated that they would use the funds to set up some type of ROSCA style bank that will lend to the various club members

in turn. Another 16% of clubs mention investment in agricultural inputs that would be used to run a demonstration plot, e.g. improved seeds. The remaining clubs mention that they intend to open a bank account, returning the interest to the club members in equal shares in some cases, while using it primarily to cover expenditures in other cases. It is notable that all uses mentioned constitute some degree of a public good. That is, no group stated that they would divvy the total up amongst themselves.

4. Empirical strategy

In this section, we outline the empirical specifications and our hypotheses. Recall that in order to test the hypotheses outlined in the introduction, we need to map up contributions to the common pot with individual characteristics, heterogeneity within the club (and each individual's "status"/"position" within this heterogeneous club) and knowledge the individuals have about each other.

In this section, we start by recognizing that we have two levels of variation in the data: within-club level variation and between-club level variation, and outline two regression models accordingly. We then define measures of heterogeneity and knowledge in detail and proceed with outlining the hypotheses using these measures.

4.1. Regression specifications

Let us denote by subscript *i,j* individual *i* belonging to club *j*. Refer to C_j as the average contribution to the common pot in club *j*. Then, our first regression model, using variation between clubs only, is specified as follows:

$$C_j = \alpha + \beta_{1,C} K_j + \beta_{2,C} H_j + \gamma_C X_j + \varepsilon_j \quad (1)$$

where K_j refers to a measure of knowledge at the club level and H_j refers to a measure of heterogeneity at the club level. X_j refers to club level control variables. These include, among others, the number of club members playing the game (denoted by N_j).

While the sample size of this regression is necessarily small, we note that, as specified below, the variable K_j (later on called knowledge 1 and knowledge 2) in particular might suffer from less sampling error at a club level compared than at an individual level as it includes the information on *N* knowledge links between members in the club rather than just the information on one knowledge link between one member and one other randomly selected variable.

The club level regression model cannot investigate the role of status an individual has within the club, or in other words, the position of each individual relative to other individuals in the club.

For this, we turn to an individual level regression model, which makes use of the total variation in contributions in the sample, both within as well as between clubs. Now, let C_{ij} denote the individual's contribution to the common pot:

$$C_{ij} = \alpha + \beta_1 K_{i,j} + \beta_2 H_{i,j} + \gamma X_j + \theta I_{i,j} + +\mu_{ij} \quad (2)$$

where $K_{i,j}$ refers to an individual's measure of knowledge and $H_{i,j}$ refers to a measure of the position of each individual within the club. Finally, $I_{i,j}$ refers to individual level control variables.

4. 2 Defining heterogeneity and position within clubs

First, let us define a measure of heterogeneity at the club level. We will define this measure for five dimensions: age, education, land owned, value of asset wealth, and per capita income. Let *x* denote one of these dimensions. Then, we can use the standard deviation of *x* to capture the degree of variation in *x* or:

$$\mathrm{H_j} = \sqrt{\sum_{\mathrm{i=1}}^{i=N_j} \left[\mathrm{x_i} - \overline{\mathrm{x_{i,j}}}\right]^2} \quad (3)$$

with:

$$\mathrm{x_{i,j}} = \sum_{i=1}^{i=N_j} x_i \quad (4)$$

At the individual level, we define the following measure of the status/position an individual has within each club:

$$H_i = |x_i - median(x_i)| \quad (5)$$

Note that (5) states that we take the absolute difference between, for instance, the age of individual i, and the median age in the club. To understand the role of status, we necessarily have to distinguish between individuals who are above the median versus below. We will hence define the following indicator variable:

$$I_i = 1 \; if \; |x_i - median(x_i)| > 0 \; and \; 0 \; otherwise \quad (6)$$

4.3. Defining within-group social knowledge

We start by defining knowledge of the other club members at an individual level. Recall that we have two sources of data on group members' knowledge about one another. The first source comes directly from the brief survey preceding the game in which we asked each club member to estimate the land owned by another (randomly) selected club member. Let us denote this answer by "estimated acreage of k(i) by i" while the actual acreage is denoted by "acreage k(i)". Note that k is dependent on i, as each club member I was just matched with one other (randomly) selected club member for this question. We can then define a first measure of knowledge, which we'll refer to as knowledge 1 throughout the rest of this article, as:

$$K_{1,i} = \frac{|acreage_{k(i)} - estimate\ acreage\ of\ k(i) by\ i|}{acreage_{k(i)}} * 100 \quad (7)$$

We note in the data that a significant proportion were unable to answer this question and answered "don't know". As Knowledge measure 1 cannot be defined for such individuals, introducing sample selection in the regression, we also define Knowledge measure 2 as the following indicator function:

$$K_{2,i} = 1\ if\ \text{estimated acreage of k(i) by i} = \text{"don't know"} \text{ and 0 otherwise} \quad (8)$$

In addition, we have a second source of information on knowledge club members have about each other. This source is the baseline survey conducted among a random sample in each village. Note that not all club members were covered in the baseline survey, just a randomly selected five, and hence using these knowledge measures will necessarily shrink the sample size of the regressions.

Using this source, we define the following four additional measures of knowledge:

$$K_{3,i} = \%\ of\ club\ members\ known\ by\ name$$
$$K_{4,i} = \%\ of\ club\ members\ sought\ advice\ from$$
$$K_{5,i} = \%\ of\ club\ members\ \ one\ could\ approach$$
$$K_{6,i} = \%\ of\ club\ members\ one\ could\ trust$$

where measures K_4 through K_5 are as a percentage of the club members known by name.

Table 3 presents descriptive statistics on these six measures of knowledge. About 60% of the club members stated that they had some idea of the acreage owned by their (randomly) selected match and ventured a guess. However, this guess is often far removed from the truth: the estimates are about 74% off, on average. Using the baseline data (note the reduction in sample size) we can see that most club members seem to know each other by name. Among the individuals they know, they feel comfortable approaching, on average, 90% of them with questions about farming and would entrust, on average, 76% of them, with a valuable item. However, past information flows appear somewhat limited, with, on average, just 27% of farmers known by name approached with a question about farming in the past one year.

Table 3 about here

For the club-level regression, we aggregate these six measures of knowledge by using the mean across the club.

4.4. Hypotheses

In the context of these measures, we test the following hypothesis:

At the club level:

- Increase in number of game members decreases contribution to the common pot
- Increase in knowledge about other game members ($K_{i,j}$) decreases the contribution to the common pot
- Increase in $H_{i,j}$ increases the contribution to the common pot

At the individual level:

- Increase in indicators of wealth, such as education, land, assets and income, increases the contribution to the common pot
- Increase in number of game members decreases contribution to the common pot
- Increase in knowledge about other game members ($K_{i,j}$) decreases the contribution to the common pot
- Increase in $H_{i,j}$ decreases the contribution to the common pot in the case of democratic decision-making process. $H_{i,j}$ * $I_{i,j}$ increases the contribution to the common pot in case of decision-making being done through a bargaining process; and the coefficient on the latter is larger in magnitude compared to the coefficient on the former

5. Results

In this section, we present the results of regression models (1) and (2). Recall that regression model (1) uses only variation between the clubs, while regression model (2) uses the total variation, both within and between clubs. Before proceeding, we discuss the results of an ANOVA test that illustrates the importance of both levels of variation: About 54% of the total variation is between club variation, while 46% of the variation is within club variation (hence the intraclass correlation is 0.51). This implies that there might be sufficient variation between clubs to shed light on the role of heterogeneity at the club level on average club-level donations.

5.1. Club level regression

Table 4 presents the results of regression model (1): the dependent variable is the average club-level contribution to the common pot. The specification in the first column uses Knowledge measure (1) – based on the discrepancy between the actual acreage of the match and the club member's estimate. The specification in the second column uses Knowledge measure (2) – based on whether or not the club member ventured a guess at all about the match's acreage. Column (3) uses the data from the baseline survey, hence restricting the sample to just five club members per club. Robust standard errors are reported below the coefficient estimates.

Table 4 about here

The results indicate that, as predicted by a traditional VCE, the number of club members decreases the average contribution, but this effect is small, and only statistically significant at the 10% level in Column (1). The various measures of club-level heterogeneity, in general, appear to have little statistically significant relationship with the average club-level contribution. In effect, just one of the variables is

statistically significant at the 5% level, and that education-based one. The size of this effect can be interpreted as follows: one increase in standard deviation in the club-level distribution of education increases the average club-level contribution by about 20 KW, which represents about 10% of the average club-level contribution (which is 175 MK).

Turning to the measures of knowledge, we again spot that none of the knowledge measures, except for Knowledge measure 4 - share of club members known by name – in Column (3) is statistically significantly different from zero. While the direction of this effect is consistent with the predictions of a VCE model with uncertainty – an increase in uncertainty increases the contribution or vice versa – the size of this effect is again small: knowing about 1 more member (out of 100) decreases the average club-level contribution with just 2 MK, which is a mere 1% of the average contribution.

As mentioned earlier, one of the limitations of using club-level data only is the sample size. Hence, we now turn to our analysis of the individual-level data below.

5.2. Individual level regression

Table 5 presents the results of regression model (2): the dependent variable is the individual contribution to the common pot. The specification in the first column uses Knowledge measure (1) – based on the discrepancy between the actual acreage of the match and the club member's estimate. The specification in the second column uses Knowledge measure (2) – based on whether or not the club member ventured a guess at all about the match's acreage. Note now the increase in sample size moving from Column (1) to Column (2). Column (3) uses the data from the baseline survey, hence restricting the sample to just five club members per club. Note the decrease in sample size again, moving from Column (2) to Column (3). Robust standard errors are reported below the coefficient estimates.

Table 5 about here

Again, the results indicate that, as predicted by a standard VCE game, that the number of game members reduces the contribution to the common pot. Having a higher level of education, more land, and a higher income is associated with a higher contribution to the common pot, as would be predicted by a standard VCE game in which the contribution is wealth-dependent. Note the relatively large coefficients on the variables education and land.

Turning to the measures of heterogeneity, as noted earlier, one of the advantages of individual level data is that we can investigate the role of the status/position of the individual with respect to the rest of the club members. We hypothesized that this relationship reflects the expectations club members have regarding how the public good will be decided upon. If the club member expects this process to happen in a democratic manner, what matters to the club member will then be how different his/her preferences are from the median preferences in the club (assuming a median voter implementation). Insofar as we can capture these preferences through our various dimensions of heterogeneity – age, education, land, assets and income – this would then imply that an increase in this distance would decrease the contribution. If the club member however expects this process to happen through a bargaining approach, then his/her understanding of his/her position in the club would matter. If we assume that a higher status is associated

with a positive, higher distance from the median, we would expect club members who are above the median to contribute more, while club members who are below the median to contribute less.

We find that an increasing distance to the median in terms of education (in in Column (2) also land) is associated with an increased contribution, but that being above the median in terms of the educational distribution (and in column (2) also land) effectively decreases the contribution, resulting in a close to null effect. Column (3) reports a similar phenomenon for the agricultural income dimension. Note that the magnitudes of these effects are not insignificant. For instance, increasing the distance to the median by one additional year of education increases the contribution by 8 to 15 MK, but only if one is located below the median. If one is located above the median, no significant effect can be noted. We discuss the implications of these findings in our concluding discussion in Section (6).

Turning our attention to the measures of knowledge, we report similar results as in the club-level analysis. An increase in knowledge measures 1 and 2 (recall that an increase in this index is associated with a decrease in knowledge) is associated with an increase in the contribution, consistent with the predictions of a VCE model under uncertainty. The magnitudes of these effects are again not insignificant. Not knowing one (random) match's acreage is associated with an increase of almost 20 MK, which represents 11% of the average contribution.

The other knowledge measures, as reported in Column (3), present a more nuanced picture. While an increase in the number of club members known by name (as a percentage of all club members) and an increase in the club members one can reportedly entrust with a valuable item (as a percentage of all club members known by name) decreases the contribution, as predicted by a VCE model; the coefficient signs on the other two measures are in the opposite direction: increasing the average number of club members one could approach (as a percentage of the club members known by name) is associated with an increase in the contribution to the common pot. While we note that none of these effects are substantial in size, we speculate that the difference in signs is due to the fact that these measures might actually be capturing different aspects of knowledge, with knowledge measures 1, 2, 3 and 6 arguably capturing closer ties, while measures 4 and 5 are capturing more distant ties. If it is the closer ties which will help one predict the preferences and behavior of others, it will be those that matter in terms of our model.

6. Concluding discussion

Farmer clubs play an important and varied role in improving the lives of millions of farmers across the developing world as they have the potential to overcome critical market failures experienced. The efficacy of farmer clubs, however crucially depends on a successful collaboration between its members which allows them to (at least partially) overcome the traditional free-riding problem. In this article, we report the results of a public goods game played with 87 farmer clubs in Malawi. In this game we asked club members to divide 1 USD between and "individual account" and a "common account", also referred to as common pot. The money in the common account is multiplied by two, but its use has to be decided upon by the club as a whole, while it is up to the individual to decide what to do with the money in the individual account.

We find that most club members play the public goods game in a somewhat cooperative manner: meaning only 5% of members contributes nothing to the common pot, while the overwhelming 95% of club members contributes at least something. We then confirm that these individual contributions link up in an intuitive manner to various individual characteristics: increase in education, land, income – all possibly measures of wealth – tend to increase the contribution to the common pot, consistent with a VCE interpretation of the game in which we assume that the money pot in the common pot will be used for a public good (instead of being returned to the players in equal shares as is commonly done in laboratory experiments). Consistent with this interpretation, we confirm that, in most specifications, the number of players decreases the contribution to the common pot, and an increase in heterogeneity in terms of the various wealth indicators tends to increase contributions to the common pot.

Introducing uncertainty, we find that increasing knowledge of other club members, tends to decrease the contribution, consistent with a VCE model with uncertainty. In addition, we find that an increase in distance between the individual's characteristics and the median of the club – capturing what we argue the individual's status within the community – increases the contribution to the public good, but only if that individual is located below the median. This is inconsistent with any straightforward model of VCE contributions under uncertainty.

Recognizing the limitations regarding extrapolation of these results to real-life behavior (see among others Harisson and List 2004 and Levitt and List 2007), these results suggest that the way a farmer club is formed might be be critical in its future performamce, and policy makers and NGO might benefit from steering this club formation process in a particular direction as to minimise the risk of various types of free-riding problems.

To address some of the externali validity concerns, in future work, we plan to map these contributions in the public good game at baseline to real-economic decisions two years down the line. In particular, we will analyse correlations with the uptake of club-level input credit and credit default, as well as the performance of the demonstration plots ran by the farmer club. In addition, we plan to include an additional regressor: risk aversion, to further explore the implications of uncertainty in this context.

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Appendix: Group Game Instructions

Before the game starts:

- Arrange to meet all the CDI club members in one central village location, secluded from the rest of the village as to avoid bystanders
- Place 400 KW in brown envelopes in notes of 50 KW (these cannot be see through), meaning 400 K per envelope, one envelop per club member.
- Place a table or map in the center area. and arrange seating in a circle.

Once all the members are present, ask every individual to introduce themselves to the group by name. Note down who is present and who is not present on the next page. **A minimum of 6 members should be present to play the game.**

Read from the following script: Good morning, I am [your name] and I came to this village to learn more about group today. Ask whether anyone would like to say a prayer, if appropriate, and continue: We would like to do a group activity with you. This activity will take about 30 minutes. But before we get started, I'll go around the group and will ask you some information about yourself.

Go around the group and fill in the notation sheet - all columns except for the two last columns. Use the Club Game Matching Number Table to select the column that matches the number of club members present and complete the 'Match Number' - second column. These numbers have been drawn randomly such that the 'Number assigned for the game' is not the same as 'Match number'.

While this information is not secret, keep the conversation with each member at a quiet volume. Keep track of spouses within the group as per notation sheet.

Continue with the script: In this activity you will each receive 400 Kwacha in this white envelop (Hold up a white envelop). Once you receive the 400 Kwacha, we will ask you to make an important decision. You will each divide up the 400 Kwacha in two parts: one part, you will put in your pocket. This part will be yours to keep and you and your family can decide what to do with it. The other part, you will put back into the envelope. You will then place the envelope back onto the table (point to the table). Once we have all made our decision, I will open these envelopes and tell you the total amount that is in the envelopes. I will then multiply this amount by 2, and place back double onto the table. So if the total amount is 500 Kwacha, I will add 500 Kwacha and place a total of 1000 Kwacha on the table. Then, you - as a group - will have to decide what to do with this money. You can decide to spend it on something for the group, or return it to the members. That decision is up to you - as a group - together.

Emphasize the following. The decision you make will be a secret decision. This is your decision and yours only. So I will ask you to go to different corners of the square and divide the money you have in secret, without anyone seeing you. You can decide to put as much or as little as you want into the envelop, so it can be 0 or 400 KW. There is no right or wrong decision. It is just a personal decision. I will also play. (Hold up your own envelop). I will come around the square and record your decision. But it will be only me knowing your decision; I will not share this information with anyone in the village. So your decision is secret. No-one else will know what you decided.

Ask whether there are any question. If not, proceed and hand out the envelopes to everyone.

Continue the script: Before you make a decision, I would like you to discuss for 5 minutes with the group what you would like to do with the group money, once you receive it.

Allow the group members to discuss in your absence for 5 minutes.

Return to the group and tell the members to disperse and make their decision. After a few minutes, go around and speak to each member. It is very important that no-one else can hear you, so go further from the others if need be. Ask the individual how much they kept to themselves and note down their contribution to the pot on the next page. Then ask them whether they happen to know their match and how much acreage the match has. Note down this stated acreage on the next page.

Do not pressurize people to make a decision quickly. Give them sufficient time. When everyone is done, ask them to place their envelope on the table. Mix the envelopes carefully. Then open the envelopes, and take out the funds. Do this quickly and try not to show too much how much is in each envelop. Count the total and announce the total. Then match the total and place the full amount on the table.

Ask: whom should I give this to?

[Write down that person's ID]

Ask: So what does your group plan to do with this money?

[Write down the answer on the next page]

Notes:

Sometimes group members might ask what they can do with the money they have: emphasize that this is up to them. They should treat this money as regular normal income.

Sometimes group members might want to know the exact amount they will get before they can discuss what to do. Tell them that you don't know this either, this will depend on what each person will put in, and they should try to discuss nevertheless.

Table 1: Selected descriptive statistics at the individual level

		Mean	St. Dev.	Median	N
(1)	Age (years)	38	13	36	1083
(2)	Education (years)	5.53	3.65	5	924
(3)	Gender (1=female, 0=male)	0.5	0.5	1	1001
(4)	Land owned (acreage)	4.85	10.46	3	1081
(5)	Having a spouse in the game (1=yes, 0=no)	0.07	0.26	0	1085
(6)	Per capita asset value (MK)	5,280,525	1,691,549	5,183,855	344
(7)	Per capita agricultural income (MK)	39,022	85,967	23,490	339

Table 2: Selected descriptive statistics at the club level

	Mean	St. Dev.	Median	N
Number of members in the club	16.83	3.60	18.00	87
Number of members in the game	12.45	4.81	12.00	87

Table 3: measures of knowledge

		Mean	St. Dev.	Median	N
(1)	Knowledge index 1	74	241	37	623
(2)	Knowledge index 2	0.42	0.49	0	1085
(3)	% of club members known	88	14	92	342
(4)	% of clubs members sought advice from	27	31	15	342
(5)	% of club members one could approach	90	21	100	342
(6)	% of club members one could trust	76	32	93	342

Notes: (1) Knowledge index 1 = the absolute difference between the estimated acreage of the match and the actual acreage of the match divided by the actual acreage of the match; (2) Knowledge index 2 = an indicator variable equal to 1 if the individual states not to have any idea bout the match's acreage. Knowledge measure (3) is derived from the answer to "Do you know who this person is?"; (4) from "Have you asked this person for advice about your farm in the last one year?", (5) from "Could you approach this person if you had a question about farming?" and (6) from "Would you trust this person to look after a valuable item for you?" Knowledge measures (4) through (6) are as a percentage of club members known.

Table 5: Regression of individual contribution to the common pot on individual and club-level characteristics

Dependent variable: Individual-level contribution to the common pot				
		(1)	(2)	(3)
(1)	Number of game members	-6.177***	-4.528***	-1.454
		(1.032)	(0.859)	(1.541)
(2)	Having a spouse in the game (1=yes, 0=no)	-31.01**	-24.90*	-34.93
		(15.63)	(14.23)	(36.68)
(3)	Age (years)	0.689	0.551	1.567
		(0.935)	(0.758)	(1.187)
(4)	Education (years)	6.744***	6.062***	13.19***
		(2.257)	(1.865)	(3.792)
(5)	Gender (1=female, 0=male)	-21.55**	-8.956	-18.98
		(9.619)	(7.967)	(14.58)
(6)	Land owned (acre)	7.462*	9.824***	1.613
		(3.914)	(2.842)	(6.042)
(7)	Per capita asset value (MK)			-6.32e-06
				(5.86e-06)
(8)	Per capita agricultural income (MK)			0.000887***
				(0.000321)
(9)	|age - median age|	1.273	0.991	0.459
		(1.315)	(1.001)	(1.719)
(10)	|land - median land|	6.420	8.774**	11.46
		(6.160)	(4.224)	(7.244)
(10)	|education - median education|	9.361***	7.989***	14.48***
		(3.133)	(2.532)	(4.433)
(11)	|asset - median asset|			-1.89e-05
				(1.43e-05)
(12)	|income - median income|			0.000862**
				(0.000394)
(13)	|age - median age| * Indicator above median	-2.926	-2.064	-3.015
		(2.046)	(1.609)	(2.777)
(14)	|land - median land| * Indicator above median	-12.34	-17.41***	-10.45
		(8.337)	(5.743)	(11.68)
(15)	|education - median education|	-10.59**	-9.142**	-22.43***
	* Indicator above median	(5.073)	(4.106)	(7.829)
(16)	|asset - median asset| * Indicator above median			-0.000315
				(0.000887)
(17)	|income - median income|			-0.00188***
	* Indicator above median			(0.000685)

Table 5 (Cont.): Regression of individual contribution to the common pot on individual and club-level characteristics

Dependent variable: Individual-level contribution to the common pot			
	(1)	(2)	(3)
(18) Knowledge index 1	0.0369***		
	(0.0119)		
(19) Knowledge index 2		19.13**	
		(8.490)	
(20) Average % of club members known			-0.939*
			(0.511)
(21) Average % of clubs members sought advice from			0.349
			(0.217)
(22) Average % of club members one could approach			0.769*
			(0.423)
(23) Average % of club members one could trust			-0.731**
			(0.283)
(24) Constant	164.3***	137.4***	127.8*
	(45.46)	(36.47)	(75.39)
Observations	496	845	282
R-squared	0.162	0.124	0.206

Notes: Robust standard errors reported in parenthesis under the coefficient estimates. * = p<0.1; ** = p<0.05 and **** p<0.001. See notes to Table 3 for definitions of (18) through (23).

Figure 1: Histogram of individual contributions to the common pot [N=1080]