Testing conditional cooperation: Local participation of farmers in agricultural cooperatives

Maria A. Naranjo
Wageningen University, the Netherlands
and
Environment for Development Initiative (EfD) - CATIE, Costa Rica

Peter Martinsson
University of Gothenburg, Sweden

and
Francisco Alpízar
Environment for Development Initiative (EfD) - CATIE, Costa Rica

Abstract:

In this paper, we test the internal and external validity of the typology of a conditional cooperator classified by using a public goods game together with the strategy method. Individuals categorized as conditional cooperators adapt their behavior to the group to which they belong. In Costa Rica, coffee farmers are traditionally organized in agricultural cooperatives, a setting very similar to the scenario presented to an individual facing the strategy method in a public goods game: how much to cooperate, given what others do. Our results show that conditional cooperators believe they contribute to the public good by matching the contribution of others in the experiment. However, we find no evidence that those classified as conditional cooperators in the experiment also behave this way when it comes to bringing coffee to the local cooperative in real life. We show supporting evidence to conclude that the typology of a conditional cooperator is internally consistent, but do not find evidence that the typology of conditional cooperators is externally valid. Our paper is a contribution to the external validity of context-free experiments and helps in understanding cooperative behavior relevant to the sustainability of agricultural cooperatives in the developing world.

Keywords: public goods experiment, conditional cooperation, agricultural cooperatives

Acknowledgments: The authors gratefully acknowledge financial support from *Formas* through the COMMONS program and the Environment for Development Initiative (EfD). We would like to express thanks to Bárbara Viguera for her support in the field, and in particular to Erwin Bulte and Janneke Pieters for their advice and helpful comments.

1. Introduction

Individual social preferences and cooperation influence collective action, with consequences for the sustainability of contracts and institutions (Fehr and Schmidt 1999; Fehr and Fischbacher 2002; Fischbacher and Gachter 2010; Charness and Rabin 2002), which are essential for community development. Social preferences and cooperation are often studied through public goods games. In this paper, we test the internal and external validity of the typology of conditional cooperator, identified by implementing a public goods game combined with the strategy method among farmers traditionally organized in agricultural cooperatives. Individuals characterized as conditional cooperators adapt their behavior to the group to which they belong (Fischbacher, Gächter, and Fehr 2001). In other words, if other group members shirk, they shirk as well, and if others cooperate, conditional cooperators follow through (Gächter 2007). In real life, participation in an agricultural cooperative consists of taking the harvest for processing to the cooperative mill, in exchange for better prices and cheaper access to technical assistance, as well as other benefits. These benefits will happen only if enough farmers cooperate in sustaining the structure of the cooperative. In other words, the agricultural cooperative setting is similar to the scenario presented to an individual facing the strategy method in a public goods game: how much to cooperate, given what others do.

A farmers' agricultural cooperative is a typical example of an institution that strongly relies on the cooperation of its members. Cooperatives are an essential vehicle for development, mobilizing local resources for a common goal that provides benefits to their associates (Zeuli and Radel 2005). The participatory structure of coffee cooperatives in Costa Rica and many developing countries reflects some of the characteristics of a public good. Membership is voluntary[1] and it is not possible to exclude members from the services of the cooperative, nor from the benefits that a cooperative typically provides to the community. Like many other institutions in the developing world, agricultural cooperatives need active cooperation from farmers to be sustainable. They represent a policy-relevant setting to test the external validity of public goods games and the strategy method.

Previous literature has focused on the external validity of public goods games. Some studies have found a positive correlation between experimental and real-life behavior (Benz and Meier 2008; Carlsson, Johansson-Stenman, and Nam 2014; Rustagi, Engel, and Kosfeld 2010; Frey

[1] An exception is Chinese cooperatives, where membership is mandatory and universal so that every farmer in the village is automatically a member.

and Meier 2004). Others have found that behavior in experiments is not consistent with real-life actions (Voors et al. 2011; Voors et al. 2012; Laury and Taylor 2008). The evidence is not only mixed, but there is little evidence regarding the typology of conditional cooperators.

The objective of this paper is to test both the internal and external validity of the conditional cooperator typology among farmers who have to decide whether or not to cooperate with the coffee cooperative. Our study contributes to this debate by directly applying a public goods game combined with the strategy method to identify the conditional cooperators (Fischbacher, Gächter, and Fehr 2001), and comparing the farmers' pro-social behavior within the experiment and outside the laboratory.

To test for internal consistency, we explore whether those identified as conditional cooperators act as such when contrasting their contributions to their beliefs about the contributions of others in the experiment. In theory, conditional cooperators should believe in contributing by matching the contributions of others in the group. We hypothesize that the conditional contribution (from the strategy method) as a function of the individual beliefs of others in the experiment is correlated with the farmer's actual contribution to the public goods game.

To test for external consistency, we compare whether the type identified in the experiment is also a characterization of real-life behavior towards the cooperative. Theoretically, conditional cooperators will either cooperate or not, according to the behavior of others in the community. We hypothesize that farmers classified as conditional cooperators bring coffee to the cooperative if the share of other farmers bringing coffee to the cooperative increases. Accordingly, those who are not conditional cooperators should not be affected by the actions of other farmers in the community.

We find a moderate correlation between the conditional contribution as a function of the individual beliefs of others in the experiment and the majority of conditional cooperators believing they contribute to the public good by matching the contribution of others in the experiment. However, we do not find a significant interaction effect between those classified as conditional cooperators in the experiment and the share of other farmers bringing coffee to the cooperative in real life. We show supporting evidence to conclude that the typology of a conditional cooperator is internally consistent, but do not find evidence that the typology of conditional cooperators is externally valid.

The rest of this paper is organized as follows: The next section describes our theoretical framework complemented by a review of recent literature on the external validity of public

goods experiments. The third introduces the background of coffee cooperative organizations in Costa Rica. Section four describes our experimental design and fieldwork implementation. Section five explains the sample selection and shows descriptive statistics. Section six presents our empirical strategy and the results, and the last section concludes the paper.

2. Related literature

Our empirical application is motivated by the seminal characterization of social preferences, a review of the literature focused on the external validity of public goods games, and the importance of studying social preferences heterogeneity in the context of agricultural cooperatives.

As defined by Fehr and Fischbacher (2002), individuals reveal social preferences when they do not care only about the resources allocated to them, but also about the resources allocated to other relevant agents. Evidence has shown that social preferences shape a substantial fraction of people's choices (Martinsson, Pham-Khanh, and Villegas-Palacio 2013; Fischbacher, Gächter, and Fehr 2001; Fehr and Fischbacher 2002; Kocher et al. 2008).

Fischbacher et al. (2001) were the first to study the hypothesis that some people are *conditional cooperators*: they are willing to cooperate more, the more others contribute to a public good. Their work has been followed by many practical applications showing that conditional cooperators account for between 50% and 80% of the participants in the population (Martinsson, Pham-Khanh, and Villegas-Palacio 2013; Fischbacher, Gächter, and Fehr 2001; Fehr and Fischbacher 2002; Kocher et al. 2008).[2]

Alternatively, individuals whose behavior does not change as a response to the behavior of others are called *unconditional cooperators* (Martinsson, Villegas-Palacio, and Wollbrant 2009). If they place a positive value on the resources allocated to others, individuals are considered *altruistic* (Putterman 2006; Fehr and Fischbacher 2002). In contrast, when individuals behave in a purely selfish manner, they are called *free riders* if they cannot be excluded from the benefits of collective action and public goods. As a result, the interaction between conditional cooperators and free riders has an impact on the dynamics of markets and organizations (Fehr and Fischbacher 2002).

[2] See Martinsson et al. (2013) for an overview of results found in different countries.

Inherently, conditional cooperation is a two-way road. Conditional cooperators adapt their behavior to the group to which they belong, meaning that if other group members defect, they defect as well; if others cooperate, conditional cooperators also cooperate (Gächter 2007). Therefore, conditional cooperation can either strengthen or undermine institutions that require cooperation to be sustainable. The composition of the group is decisive in maintaining cooperation (Rustagi, Engel, and Kosfeld 2010), and cooperation is achieved in groups with a larger share of conditional cooperators (Gunnthorsdottir, Houser, and McCabe 2007; Ones and Putterman 2007). Institutions, where most individuals are conditional cooperators, need to have policies that stand the beliefs for the cooperation of their members. If free riders dominate, procedures should involve monitoring and penalties to reinforce cooperation (Gächter 2007; Martinsson, Villegas-Palacio, and Wollbrant 2009).

Regarding the external validity of public goods games, some studies have found a positive correlation between experimental and real-life behavior. For example, Benz and Meier (2008) find evidence that pro-social behavior is accentuated in the lab but is, to some extent, correlated with behavior in the field. Carlsson et al. (2014) find that correlations between public goods game contributions and real-life contributions are not only present but also stable over long periods and contexts. On the other hand, some studies have found that behavior in experiments is not consistent with real-life actions. A series of studies by Voors et al. (2012, 2011) finds no correlation between two experiments: a social intervention that mimics a public goods game and the conventional public goods game (Voors et al. 2012), nor a robust pattern between the previous experiments and real-life behavior towards forest conservation in Sierra Leone (Voors et al. 2011). Laury and Taylor (2008) suggest that not all estimates of social preferences from a laboratory setting predict contributions on naturally occurring public goods. They find some estimates of altruistic behavior carry over to real life, but it was not the same for the free riders.

Recent literature has shown the importance of studying preferences heterogeneity in the context of conditional cooperation. Rustagi et al. (2010) show evidence on the extent to which variation in the composition of the group explains the success of forest management in Ethiopia. They combine experimental estimates of conditional cooperation and survey data among organized forest user groups. Groups vary in the share of conditional cooperators, and groups with a larger conditional cooperator share are more successful in forest management. They also show that instruments such as costly monitoring are essential to enforcing cooperation among conditional cooperators. Frey and Meier (2004) find that charitable giving increases, on average, if people know that many others contribute as well.

Overall, we found few studies that assess the external validity of the typology of conditional cooperation (Rustagi, Engel, and Kosfeld 2010; Frey and Meier 2004). Our study contributes to this debate by applying a public goods game following the strategy method (Fischbacher, Gächter, and Fehr 2001) and comparing the farmers' pro-social behavior in an experiment and outside the laboratory using a population of coffee farmers in Costa Rica.

In the next section, we introduce the background of coffee cooperatives in our study area, their participatory structure, and why conditional cooperation is essential for the sustainability of these organizations.

3. Background on coffee cooperatives

Although coffee is no longer the main agricultural export of the country, it remains a leading agricultural commodity. According to the Costa Rican Coffee Institute (ICAFE), there are around 41,300 coffee growers (11,180 less than in 2008), producing roughly over 2 million coffee bean *fanegas*[3] annually (ICAFE 2018). The coffee sector is mostly composed of small-scale growers (90%), who produce less than 100 coffee *fanegas* per year (ICAFE 2018). These small-scale farmers are traditionally organized in agricultural cooperatives, but coffee mills are either privately owned or cooperative, and both coexist throughout the country.

During harvesting season, the coffee beans must be processed quickly, before they can ferment, and therefore the farmers bring their coffee to collection points available in each village soon after harvest. These collection points are set up by both the cooperative and the private mills and are spread around the villages. Farmers gather in line at the end of the day to deliver the coffee at these collection points. Hence, the information about who brings their coffee where, either to the private or the cooperative mill, can be considered public information among farmers.[4]

[3] A *fanega* is a standard unit of volume to measure coffee in Central America, of approximately 250 kg.

[4] The governance structure in these cooperatives is participatory. For example, in Coope Tarrazú, for every 15 associates, a delegate is appointed to be part of the General Assembly. The General Assembly's main functions are to approve the policies of the cooperative and to decide about surpluses, coffee processing, and commercialization. Also, the General Assembly appoints other governing bodies, including the Administration Board, the Surveillance Committee, the Education Committee and the Arbitration Board (CoopeTarrazú 2018). Once the Administration Board is elected, each of the administrative positions is appointed internally. The Board of Directors decides all matters related to the management of the cooperative, and selects the General Manager, the Internal Audit and the External Audit (CoopeTarrazú 2018).

The cooperative supports farmers with access to inexpensive technical assistance and training to improve productivity and reduce the risk of pests and diseases. Members of a cooperative can choose between using the cooperative mill (receiving higher prices, but not immediate payment) and using private mills (lower prices, immediate payment). Coffee growers who choose to get their beans processed at the cooperative mill add value to the product and get better prices through sales to international roasters if quality and quantity of the coffee are high. However, it is not possible to exclude members from the mill or other services if they produce poor quality beans or sell part or all of their beans elsewhere. The structure of coffee cooperatives resembles the characteristics of a public good. It is not possible to exclude those who do not cooperate. In principle, farmers should cooperate with one another by bringing their coffee to the local cooperative. However, in reality, many farmers bring all or part of their coffee harvest to private mills that attract farmers with direct cash payments. Prices offered by the private mills are not necessarily higher than the price provided by the cooperatives, but payments are given to the farmer on the spot.

In contrast to the private mills, when farmers bring their coffee to a cooperative, they receive payments distributed throughout the year (see Annex 1 for a list of prices and Annex 2 for an example of the timing of the payments in 2014).[5] Furthermore, there are also benefits from cooperatives beyond coffee production per se that reach the entire community. Agricultural cooperatives are well known for sponsoring sports and cultural and educational projects in the coffee regions for all members of the community independently of membership.

Agricultural cooperatives need cooperation from the local farmers to keep functioning. Contracts with international coffee roasters are made in advance (before the harvest), and quotas must be achieved. If the majority of farmers are conditional cooperators, they will bring coffee to the cooperative mill if other farmers in the community do so, but they will not participate if other farmers do not. Therefore, conditional cooperation can either enhance or weaken cooperation, depending on the proportion of farmers who are free riders and do not bring their coffee for processing.

[5] Both cooperative and private mill prices are regulated by law. The final price is published before the harvest season and includes a 9% from the final liquidation price in favor of the coffee mill for the processing and marketing of coffee (MAG 2016).

4. Experimental design and procedures

Our public goods experiment is based on the experimental design developed by Fischbacher, Gächter, and Fehr (2001). The one-shot experiment allows us to investigate both cooperative behavior directly as well as underlying preferences for cooperation, and it consists of three stages: (i) an unconditional contribution, (ii) conditional contributions and, (iii) elicitation of the beliefs about other group members' unconditional contributions (detailed instructions are given in Annex 4).

In the first stage, which is unconditional contribution to the public good, farmers receive an endowment of 20 points each and they are asked how to allocate them between a private and a public good. The can choose to invest some, none or all of the endowment in the public good, but they had to choose an integer number. The payoff function for subject *i* is

$$\pi_i = 20 - g_i + 0.5 \sum_{j=1}^{3} g_j$$

where g_i is the unconditional contribution, and the public good pays back the sum of all contributions g_j multiplied by 0.5, which is the marginal per capita return from investing in the public good. The choice of a marginal per capita return equal to 0.5 fulfills the conditions of a social dilemma since from an individual perspective free-riding is a dominant strategy for every payoff-maximizing decision maker while contributing the entire endowment is the social optimal decision. Furthermore, a the marginal per capita return of 0.5 facilitates explanation of the return from the investment in the public good. Basically, we told the subjects that the sum of all contributions to the public good is increased by 50% and then divided equally among all group members.

In the second task, which is the conditional contribution, the farmers complete the contribution table. The farmer must indicate, for each possible average contribution of the other two farmers in the group, which is rounded to integers ranging from 0 to 20 point, the number of points to invest in the public good (see Annex 6). Thus, farmers state how much they are willing to contribute conditional on the average contribution of the other two members of the group. There is an important difference between unconditional and conditional contribution, where in the latter case, there is no strategic uncertainty since a farmer knows for sure how much others contribute. Farmers are told that one member of each group is selected, and their income will

be determined according to the table of contributions. For the other two farmers in the group, the income will be the unconditional contribution payoff.

The important feature of the design by Fischbacher, Gächter, and Fehr (2001) is that both the unconditional and the conditional contributions are incentive compatible because they can determine a farmer's payoff. In practice, one group member is randomly selected for whom the conditional contribution is payoff-relevant, while for the other two group members their unconditional contributions determine their payoffs. The contribution to the public goods for the randomly selected farmer in the group is determined as the conditional contribution from the table corresponding to the average of unconditional contributions of the other two group members rounded to a closest integer number.

In the final stage, we asked the farmers how much they think the other two farmers of the group have contributed in task 1, i.e., unconditional contribution, rounded to integer number (see Annex 7). Following, for example, Gächter and Renner (2010), we monetarily incentivize correct guesses. If the farmer guesses the average contribution from the other two farmers to the project account, they could earn additional points. If the exact unconditional contribution of others is equal to the guessed contribution, the farmer earns four extra points. If the real contribution is a point above or below, the farmer earns three extra points. If the contribution is two points above or below, the farmer earns one extra point. At the end of the game, the coordinator arrives with the information collected from the other two farmers, and payment is given in cash directly to the farmer.

The experiment was conducted simultaneously with the farmers in their households. The enumerator explained the public goods experiment to them and conducted the three stages as described above. At the beginning of the experiment, the enumerator informed the farmer that he or she is matched with other farmers who are at the same time conducting the same experiment in their households. Farmers are told that they are simultaneously playing in a group with two other anonymous peer farmers from the community chosen at random and that their contributions are sent by SMS to the coordinator. The coordinator collects the information from the other participants and calculates the payoffs (see Annex 5). At the end of the game, all points are converted to Costa Rican colones at the rate of 1 point equal to 200 Costa Rican colones.[6]

[6] In dollars, the 20 points are equivalent to 7 USD.

5. Sample selection and data

Our study took place in 2014 in two coffee regions in Costa Rica: Tarrazú and Brunca. In the Tarrazú area, there are three main cooperatives: Coope Llano Bonito, Coope Dota and Coope Tarrazú, which have 600, 900 and 4650 members respectively. In the Brunca region, there is one big cooperative call Coope Agri that registers a total of 10,162 associates and is the largest cooperative in the country.[7] Households were sampled through a stratified random sampling based on the density of coffee plots within six districts of the two coffee regions (three districts from each region).[8] Districts were chosen to capture the spread and variation of intensity of the coffee rust epidemic in 2012-2013.[9] In our final sample, we have 293 households of coffee farmers.

Household head farmers took part in the fieldwork data collection carried out by trained enumerators at each household. First, a survey questionnaire collected detailed household characteristics, farming practices, and community participation in different organizations. Then, the enumerator introduced the public goods game. Their household socioeconomic characteristics and coffee farm characteristics are presented in Table 1. In our sample, coffee farmers have on average only primary education, life experience in coffee farming, and on average, 57% of their income is earned through selling coffee. For our main cooperation variable, we gathered information on where farmers delivered their coffee. Specifically, we asked for each of their plots whether the coffee was delivered to the cooperative mill, to a private mill or both. Hence, we know with certainty that those bringing coffee to the cooperative mill are members, but we are not able to identify those who are members and do not bring coffee to a local cooperative.

In our empirical model, farmers' cooperation is defined by bringing or not bringing coffee to the local cooperative (P_i). We focus on the interaction of the typology of social preferences with the cooperation of other farmers in the village. To measure the participation of other farmers in the village (PO_{ij}), we take the share of other farmers in the village who bring their coffee to the cooperative, excluding farmer *i*.

[7] Coope Agri also processes other agricultural products, not only coffee, and provides financial services.
[8] Costa Rica's national public administration divides the country into provinces, cantons, and districts.
[9] Coffee rust epidemic was an exogenous shock which affected coffee plantations at an altitude between 700 and 2000 meters above sea level.

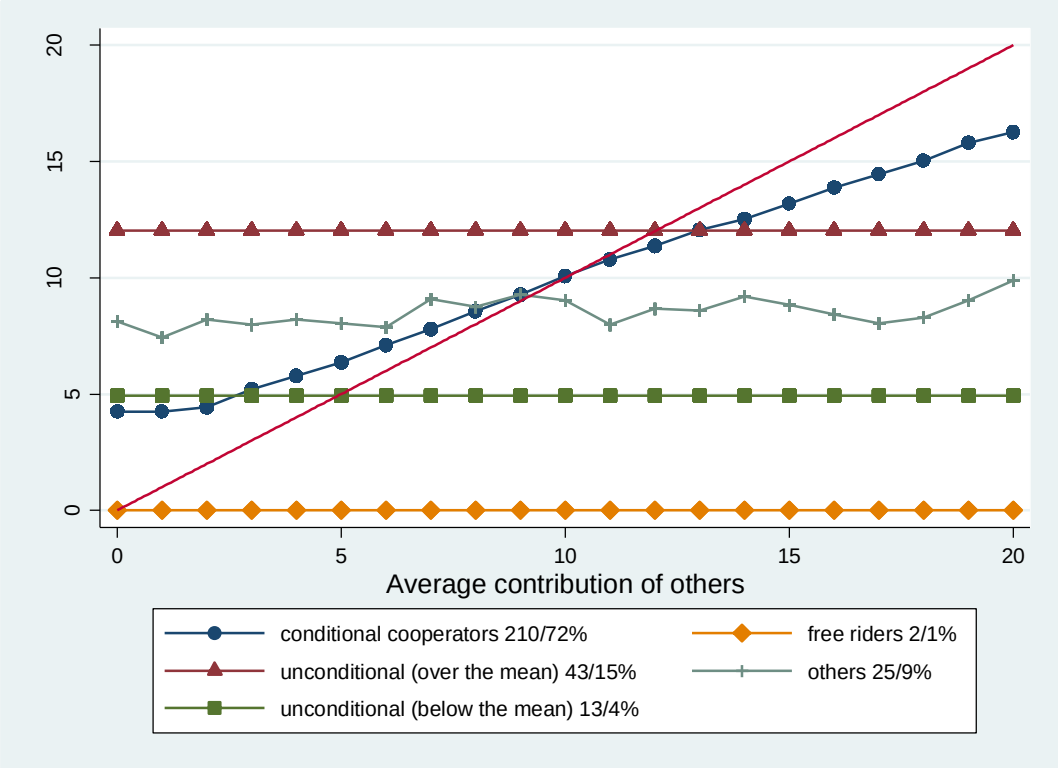
Table 1. Descriptive statistics of main variables

	N	*mean*	*sd*	*min*	*max*
Household variables					
Willingness to contribute to public goods game	293	9.67	3.83	0	20
Household head female	293	0.10	0.30	0	1
Age (years)	293	51.77	13.64	19	86
Education (years)	293	5.80	2.61	0	15
Household size	293	3.33	1.38	1	10
Total farm area (ha)	293	5.49	9.96	0.03	109
Coffee farm characteristics					
Farmer experience (years)	293	25.50	14.48	1	71
% of income coming from coffee	278	56.78	36.20	0	100
Total area planted with coffee (ha)	293	3.48	4.62	0.09	41.77
Farm affected by coffee leaf rust	293	0.81	0.39	0	1
Have a credit with the cooperative	293	0.11	0.32	0	1
Farmers bringing any coffee to a private mill	293	0.26	0.44	0	1
Main variables					
Farmers bringing any coffee to a cooperative (P_i)	293	0.78	0.42	0	1
Share of other farmers in the village bringing coffee to the cooperative (PO_{ij})	293	0.78	0.17	0.29	1

6. Empirical strategy and results

Following Fischbacher et al. (2001) and Fischbacher and Gächter (2010), we used the experimental data to classify farmers in distinct contributor categories: the conditional cooperators, the unconditional contributing over the mean, the unconditional contributing below the mean, the free riders, and the remaining others (Figure 1). *Conditional cooperators* are farmers whose own conditional contribution increases weakly and monotonically with the average contribution of other members. These include subjects for whom the relationship between their average contribution and that of others is positive and significant at the 1% significance level, based on the Spearman correlation coefficient (Fischbacher et al., 2001). The farmers who always report the same contribution from the first task, independently of the average contribution of the other two farmers, are classified as *unconditional cooperators*.

Figure 1. Average own conditional contribution for each contribution level of the other group members (diagonal = perfect conditional cooperators)



Our biggest group is the *conditional cooperators* with 210 farmers (72%), who tend to match the expected contributions of others. This percentage is consistent with results from previous lab studies. However, in previous research, the majority of conditionally cooperative contributions tend to lie at or below the diagonal (in the selfish direction) (Fischbacher, Gächter, and Fehr 2001). Conversely, in our sample, conditional cooperator farmers start contributing on average above the diagonal, and, after the average contribution of 10 tokens, contributions fall below the diagonal.

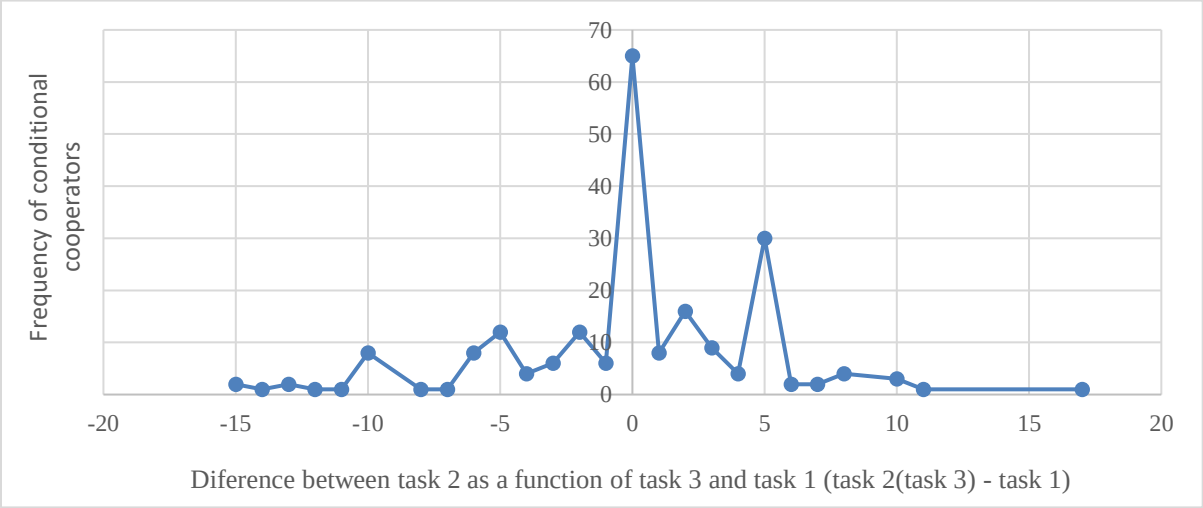
Unconditional cooperators account for 19% (56 of the subjects). These include 43 farmers (15%) who always contribute above the mean and 13 who always contribute below the mean (4%). We found only two free riders displaying purely selfish behavior with a contribution of

zero (1%).[10] Finally, 25 farmers (9%) are classified as *other*. For further analysis, we include the two free-riders within the group of others.[11]

We start by testing the internal validity of the typology of conditional cooperators. As detailed in section 3, our experiment included three tasks. Task 1 asked farmers their willingness to contribute to a public good. In task 2, we elicited farmers' willingness to cooperate conditionally on the average cooperation of other farmers, and, in task 3, we asked farmers about their beliefs regarding the contribution of others.

We wanted to know if the conditional contribution (task 2), as a function of the individual beliefs of others (task 3), is correlated with the farmer's actual contribution to the public goods game (task 1). We test the null hypothesis that the public good contribution (task 1) and conditional contribution as a function of the individual beliefs about others (task 2(task 3)) are independent. We reject the null hypothesis and find a Spearman's correlation coefficient equal to 0.4126, showing a moderate correlation which is highly significant (p-value < 0.01).

Figure 2. Frequency of farmers matching their beliefs with their willingness to contribute to the public good.



[10] Previous studies in the lab typically found a higher percentage of pure free riders (4-6%) (Martinsson, Pham-Khanh, and Villegas-Palacio 2013).

[11] Previous literature also identifies a category called the *hump-shape contributors* (Martinsson, Pham-Khanh, and Villegas-Palacio 2013; Fischbacher, Gächter, and Fehr 2001; Fehr and Fischbacher 2002; Kocher et al. 2008). These are subjects showing a monotonically increasing contribution up to an average level of others, after which contributions decrease. From our data, we do not find farmers displaying this behavior.

Furthermore, we compared one by one to see whether those classified as conditional cooperators remained consistent in the experiment. For example, if a farmer believed that on average the other two farmers contributed five tokens (in task 3), we looked at how much the farmer was willing to contribute if the other two farmers contributed on average five (table of contributions, task 2), and then compared this result with their original contribution (task 1). Figure 2 shows the frequency of farmers matching their beliefs with their willingness to contribute to the public good. The large majority of conditional cooperators, a total of 130 out of the 210 (62%), remained "consistent" within -/+ 1 standard deviation of 3.83 ≈ 4 from their original contribution. Furthermore, 31% perfectly matched their contribution to their beliefs. Our results show supporting evidence to conclude that the typology of a conditional cooperator is consistent within the experiment.

To test for external consistency of the typology of conditional cooperation, we examine whether conditional cooperators will cooperate, according to the behavior of the other farmers in the community. We explore the aggregated behavior at the village level following the study by Rustagi et al. (2010). We look at the share of behavioral types and the outcome variable of cooperation in each village, estimated as the total share of farmers bringing coffee to the cooperative (Figure 3).[12]

We regress the share of farmers bringing coffee to the cooperative in each village (SP_j) on the share of conditional cooperators in each village (SCC_j). We control for relevant factors at the village level such as the share of female household heads, average elevation from farms in the village, average total area planted with coffee, and village sample size (X_j). The error term is denoted by $\varepsilon_{ij,}$ and the model is specified as follows:

$$SP_j = \alpha + \beta_1 SCC_j + \ X_i + \ \varepsilon_{ij}$$

Ordinary least squares (OLS) estimates are presented in Table 2. To ensure robustness, standard errors are clustered at the village level (33 clusters), and we applied the wild bootstrap with 1000 repetitions (Cameron, Gelbach, and Miller 2008). The coefficient for the share of conditional cooperation is positive and not significant. Hence, we do not find evidence that the share of conditional cooperation in the village affects the participation of farmers in the local

[12] We present the frequency distribution of farmers' social preferences in Annex 3.

agricultural cooperatives. Our results are different from Rustagi et al. (2010), who find that groups with a larger share of conditional cooperators are more successful in forest management.

Figure 3. Share of behavior types and village cooperation towards the cooperative

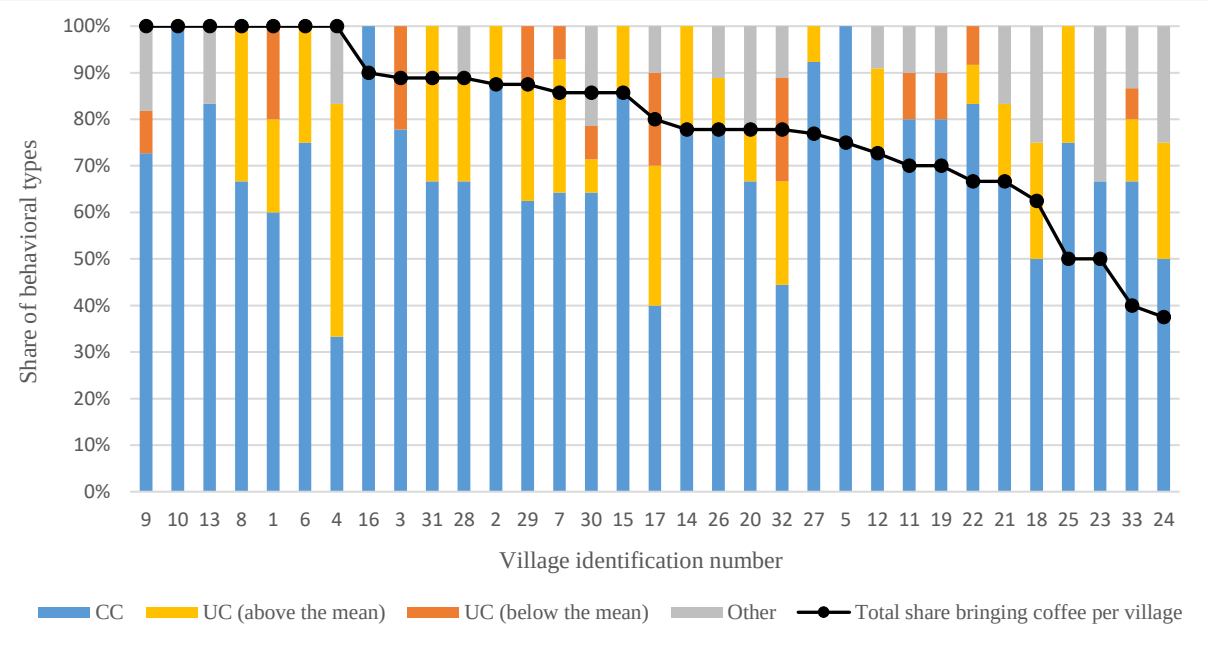


Table 2. Farmers' participation in local agricultural cooperatives and conditional cooperation.

	Dependent variable:		
	Share of farmers bringing coffee to local cooperative		
	(1)	(2)	(3)
Share of conditional cooperators (sample/village)	**0.1418**	**0.1577**	**0.1577**
	[0.1885]	**[0.1978]**	**[0.2005]**
Constant	0.6921***	0.8436***	0.8436***
	[0.1489]	[0.2517]	[0.2475]
Other control variables	No	Yes	Yes
Wild bootstrap	No	No	Yes
Observations	33	33	33
R-squared	0.018	0.114	0.114

The independent variables are the average elevation in sample/village, the area planted with coffee in sample/village, and the number of farmers in sample/village. We apply the wild bootstrap following Cameron et al. (2008). Cluster standard error at the village level (33 villages). Robust standard errors in brackets, *** p<0.01, ** p<0.05, * p<0.1.

Our hypothesis stated that farmers classified as conditional cooperators are more likely to bring coffee to the cooperative if the share of other farmers bringing coffee to the cooperative increases. Therefore, we add further analysis to specifically test this hypothesis and look at the interaction effect between the type of cooperator and the share of other farmers in the village bringing coffee to the local cooperative.

We regress as the dependent variable whether farmer *i* brings coffee to the cooperative in village *j* (P_{ij}), on the classification of pro-social behavior types: conditional cooperators (CC_{ij}), unconditional cooperators (UC_{ij}) and others (O_{ij}), the share of other farmers bringing coffee to the cooperative (PO_{ij}), and the complete interaction effects with the type of cooperator. We control for a set of household controls (X_i). The error term is denoted by ε_{ij}. To ensure robustness, standard errors are clustered at the village level (33 clusters), and we include fixed effects at the district level (6 districts) and apply the wild bootstrap with 1000 repetitions (Cameron, Gelbach, and Miller 2008). We set those classified as conditional cooperators as the reference group, and the model is specified as follows:

$$P_{ij} = \alpha + \beta_1 UC_i + \beta_2 O_i + \beta_3 PO_{ij} + \beta_4 (UC_i \times PO_{ij}) + \beta_5 (O_i \times PO_j) + X_i + \varepsilon_{ij}$$

Ordinary least squares (OLS) estimates are presented in Table 3. The coefficient for those classified as unconditional cooperators (UC_i) is negative but not significant, meaning that they are no different from those classified as conditional cooperators (CC_i). The same result is found for those in the category of others (O_i). The coefficient for the share of other farmers in the village bringing coffee to the cooperative (POij) is positive but not significant, indicating that the behavior of others has no significant effect on whether or not farmer *i* brings coffee to the cooperative, for the reference group of conditional cooperators. Furthermore, there are no significant differences when looking at the interaction effect with the unconditional cooperators (UC_i X PO_{ij}) and others (O_i X PO_{ij}). In summary, we do not find a significant impact of the share of other farmers bringing coffee on the participation of conditional cooperators, and this is no different for the unconditional cooperators.

Table 3. Farmers' participation in local agricultural cooperatives, type of cooperator and interaction effect with the participation of other farmers in the village

Base category: Conditional cooperator (CC_i)	Dependent variable: Dummy for farmers bringing any coffee to a cooperative (P_i)	
	(1)	(2)
Unconditional cooperator (UC_i)	-0.0959 [0.4059]	-0.0959 [0.5357]
Others (O_i)	-0.5381 [0.4607]	-0.5381 [0.7505]
Share of other farmers in the village bringing coffee to coop (PO_{ij})	0.1204 [0.3335]	0.1204 [0.6033]
UC_i X PO_{ij}	0.1046 [0.4813]	0.1046 [0.5843]
O_i X PO_{ij}	0.6865 [0.5622]	0.6865 [0.8648]
Women	0.0730 [0.0579]	0.0730 [0.0661]
Education (years)	-0.0031 [0.0123]	-0.0031 [0.0142]
Household size	0.0118 [0.0209]	0.0118 [0.0228]
Total farm area (ha)	-0.0036 [0.0025]	-0.0036 [0.0032]
Farming experience (years)	0.0070*** [0.0015]	0.0070*** [0.0000]
Total area planted with coffee (ha)	0.0074 [0.0053]	0.0074 [0.0057]
Farm affected by the coffee leaf rust fungus	0.0703 [0.0714]	0.0703 [0.0776]
Patience[1]	-0.0050 [0.0090]	-0.0050 [0.0084]
Diversify with other crops	-0.0160 [0.0482]	-0.0160 [0.0432]
Household received remittances	-0.1150 [0.1402]	-0.1150 [0.1468]
Have a credit with the cooperative	0.2369*** [0.0556]	0.2369*** [0.0000]
Constant	0.4091 [0.3401]	0.4091 [0.5456]
District fixed effects	Yes	Yes
Wild bootstrap	No	Yes
Observations	293	293
R-squared	0.167	0.167

[1] A measure of patience from survey questionnaire, where 0 means very impatient and 10 means very patient.
Fixed effects at the district level (6 districts). Wild bootstrap following Cameron et al. (2008). Cluster standard error at the village level (33 villages). Robust standard errors in brackets, *** p<0.01, ** p<0.05, * p<0.1.

To further understand cooperation towards the cooperative, we take a look at the control variables in the previous model. The coefficient for farming experience is positive and highly significant (p-value < 0.01). As reported in Table 1, farmers have on average a farming experience of 25.50 years; with an increase of one standard deviation (14.48), the probability of farmers bringing coffee to the local cooperative is predicted to increase by 11%. In further consultation with local cooperatives, it is clear that tradition is an essential factor explaining cooperation towards the cooperative (Murillo-Monge 2018). Farming experience, in this case, can work as a proxy for a farmer's tradition in the coffee business. Farmers with more farming experience are also the older farmers who traditionally have brought coffee to the local cooperative since its origins. An implication of this finding is that agricultural cooperative organizations should enhance policies to actively involve young coffee farmers in the cooperative organization.

The coefficient for having credit with the cooperative is also positive and highly significant (p-value < 0.01). Farmers having credit with the cooperative are 24% more likely to bring coffee, compared to the baseline probability of 40%. Agricultural cooperatives have grown strong over the years and many functions as financial institutions that give credit to farmers. Our results suggest that cooperatives have the ability to engage farmers via credits to ensure part of their harvest as a payment mechanism.

7. Conclusions and discussion

In this paper, we test whether the typology of conditional cooperation, derived from a public goods game using the strategy method, is internally consistent and whether the typology carries through to reality. In other words, if we find that a farmer is a conditional cooperator, what is the farmer's behavior in real life concerning supporting local agricultural cooperatives? If farmers are conditional cooperators, we expect they will match the behavior of others in real life.

Agricultural cooperatives need farmers to cooperate (e.g., bring coffee to the cooperative). Consequently, cooperatives should be concerned if there is a significant share of free riders (e.g., those who do not bring coffee to the cooperative). Free riders not only lower the total production process of the cooperative but also can bring down the contributions of the conditional cooperators in the community. Results from a public goods game using the strategy

method shows there is experimentally minimal pure free riding. However, the majority of farmers are conditional cooperators (72%), an important group that can enhance cooperation but can also weaken the cooperative structure if farmers hesitate to bring coffee to the local cooperative.

We find a moderate correlation between conditional contribution as a function of individual beliefs about others in the experiment. The majority of conditional cooperators believe their contribution to the public good matches the contribution of others in the experiment. However, we do not find a significant interaction effect between those classified as conditional cooperators in the experiment and the share of other farmers bringing coffee to the cooperative in real life.

In other words, we find the typology of conditional cooperator to be consistent within the experiment, but it does not carry over outside the laboratory into a real-life setting. The lack of correlation suggests that social preferences can be related to a particular context or setting. Our results are in line with other types of social preferences measures in the lab that do not relate to pro-social preferences measured in real life (Voors et al. 2011; Voors et al. 2012; Laury and Taylor 2008). Similar results have also been found in the case of risk preferences (Naranjo, Alpízar, and Martinsson 2018). Hence, one should be careful when extrapolating the typology of conditional cooperation measures in the lab to other real-life contexts.

Given our results, a question that arises is whether farmers see the action of bringing coffee to a local cooperative as a public good. We have no doubt that the agricultural cooperative has been an essential institution for development in the rural areas of Costa Rica, delivering benefits to households regardless of whether they are coffee farmers. However, cooperatives are also known for not excluding yields on the basis of quality. Therefore, there are cases where the only place that accepts the coffee is a local cooperative. As a consequence, there can be any typology (i.e., conditional, unconditional cooperators, altruists, and free riders) producing low-quality coffee and the only place they can deliver coffee is the local cooperative. Furthermore, in the last years, there has been a growing establishment of micro mills and farmers trying to differentiate themselves from the crowd by processing and marketing their coffee. These are details that together make it difficult to consider our real-life scenario a perfect public goods game with which to look for external validity.

References

Benz, Matthias, and Stephan Meier. 2008. “Do People Behave in Experiments as in the Field?-Evidence from Donations.” *Experimental Economics* 11 (3): 268–81. doi:10.1007/s10683-007-9192-y.

Cameron, A. Colin, Jonah B. Gelbach, and Douglas L. Miller. 2008. “Bootstrap-Based Improvements for Inference with Clustered Errors.” *The Review of Economics and Statistics* 90 (3): 414–27. doi:10.3368/jhr.50.2.317.

Carlsson, Fredrik, Olof Johansson-Stenman, and Pham Khanh Nam. 2014. “Social Preferences Are Stable over Long Periods of Time.” *Journal of Public Economics* 117. Elsevier B.V.: 104–14. doi:10.1016/j.jpubeco.2014.05.009.

Charness, Gary, and Matthew Rabin. 2002. “Understanding Social Preferences with Simple Tests.” *The Quarterly Journal of Economics* 117 (3): 817–69.

CoopeTarrazú. 2018. “CoopeTarrazú.” *CoopeTarrazú*. http://cafetarrazu.com/.

Fehr, Ernst, and Urs Fischbacher. 2002. “Why Social Preferences Matter-The Impact of Non-Selfish Motives on Competition, Cooperation and Incentives.” *The Economic Journal* 112 (478): 1–33. doi:10.1111/1468-0297.00027.

Fehr, Ernst, and Klaus M. Schmidt. 1999. “A Theory of Fairness, Competition, and Cooperation.” *Quarterly Journal of Economics*, 114 (3): 817–68. doi:10.1162/003355399556151.

Fischbacher, Urs, Simon Gächter, and Ernst Fehr. 2001. “Are People Conditionally Cooperative? Evidence from a Public Goods Experiment.” *Economic Letters* 71 (3): 397–404. doi:10.2139/ssrn.203288.

Fischbacher, Urs, and Simon Gachter. 2010. “Social Preferences, Beliefs, and the Dynamics of Free Riding in Public Goods Experiments.” *American Economic Review* 100 (1): 541–56.

Frey, Bruno S., and Stephan Meier. 2004. “Pro-Social Behavior in a Natural Setting.” *Journal of Economic Behavior and Organization* 54 (1): 65–88. doi:10.1016/j.jebo.2003.10.001.

Gächter, Simon. 2007. “Conditional Cooperation: Behavioral Regularities from the Lab and the Field and Their Policy Implications,” in *Economics and Psychology. A Promising*

New Cross-Disciplinary Field, edited by Bruno S. Frey and Alois Stutzer. Cambridge, MA: MIT Press, 2007.

Gunnthorsdottir, Anna, Daniel Houser, and Kevin McCabe. 2007. "Disposition, History and Contributions in Public Goods Experiments." *Journal of Economic Behavior & Organization* 62 (2): 304–15. doi:10.1016/j.jebo.2005.03.008.

ICAFE. 2014. "Final Settlement Price Harvest 2013-2014." San José, Costa Rica: Coffee Institute of Costa Rica (Instituto del Café de Costa Rica).

Kocher, Martin G., Todd Cherry, Stephan Kroll, Robert J. Netzer, and Matthias Sutter. 2008. "Conditional Cooperation on Three Continents." *Economics Letters* 101 (3). Elsevier B.V.: 175–78. doi:10.1016/j.econlet.2008.07.015.

Laury, Susan K., and Laura O. Taylor. 2008. "Altruism Spillovers: Are Behaviors in Context-Free Experiments Predictive of Altruism toward a Naturally Occurring Public Good?" *Journal of Economic Behavior & Organization* 65 (1): 9–29. doi:10.1016/j.jebo.2005.05.011.

MAG. 2016. *Regulations to the Law Regarding the Regime of Relations between Producers, Coffee Mills, and Exporters of Coffee (Law No. 2762). Minister of Agriculture and Livestock*. Vol. N°28018-MA.

Martinsson, Peter, Nam Pham-Khanh, and Clara Villegas-Palacio. 2013. "Conditional Cooperation and Disclosure in Developing Countries." *Journal of Economic Psychology* 34: 148–55. doi:10.1016/j.joep.2012.09.005.

Martinsson, Peter, Clara Villegas-Palacio, and Conny Wollbrant. 2009. "Conditional Cooperation and Social Group - Experimental Results from Colombia." *Working Papers in Economics*, August. University of Gothenburg, Department of Economics. https://ideas.repec.org/p/hhs/gunwpe/0372.html.

Murillo-Monge, Jorge Eduardo. 2018. "Ex-Manager, CoopeTarrazú R.L." *Personal Communication with Authors*.

Naranjo, Maria A., Francisco Alpízar, and Peter Martinsson. 2018. "Alternatives for Risk Elicitation in the Field: Evidence from Coffee Farmers in Costa Rica." (Working Paper).

Ones, Umut, and Louis Putterman. 2007. "The Ecology of Collective Action: A Public Goods and Sanctions Experiment with Controlled Group Formation." *Journal of Economic*

Behavior & Organization 62 (4): 495–521. doi:10.1016/j.jebo.2005.04.018.

Putterman, Louis. 2006. "Reciprocity, Altruism, and Cooperative Production," in *Handbook of the Economics of Giving, Altruism and Reciprocity, Vol. 2,* edited by Serge-Christophe Kolm and Jean Mercier Ythier. Amsterdam: Elsevier B. V. doi:10.1016/S1574-0714(06)02022-7.

Rustagi, Devesh, Stefanie Engel, and Michael Kosfeld. 2010. "Conditional Cooperation and Costly Monitoring Explain Success in Forest Commons Management." *Science* 330 (November): 961–65. doi:10.1126/science.1193649.

Voors, Maarten, Erwin Bulte, Andreas Kontoleon, John A. List, and Ty Turley. 2011. "Using Artefactual Field Experiments to Learn about the Incentives for Sustainable Forest Use in Developing Economies." *American Economic Review* 101 (3): 329–33. doi:10.1257/aer.101.3.329.

Voors, Maarten, Ty Turley, Andreas Kontoleon, Erwin Bulte, and John A. List. 2012. "Exploring Whether Behavior in Context-Free Experiments Is Predictive of Behavior in the Field: Evidence from Lab and Field Experiments in Rural Sierra Leone." *Economics Letters* 114 (3). Elsevier B.V.: 308–11. doi:10.1016/j.econlet.2011.10.016.

Zeuli, Kimberly, and Jamie Radel. 2005. "Cooperatives as a Community Development Strategy: Linking Theory and Practice." *The Journal of Regional Analysis and Policy* 35 (1): 43–55.

Annex 1. Final liquidation prices. Harvest 2013-2014

Mills reported in Tarrazú and Brunca Region		Ripe	Green
Cooperatives	Coope Dota R.L.	87,437.99	60,717.44
	Coope Llano Bonito R.L.	78,077.12	
	Coope Tarrazú R.L.	**69,646.40**	48,339.90
	Coope Agri El General R. L.	60,567.93	41,394.65
Private Mills	Beneficio la Candelilla de Tarrazú S.A.	101,915.99	
	Beneficio Volcafé (C.R.) S.A. San Diego	64,309.71	44,681.29
	Benefocio Volcafé (El General)	42,660.80	29,230.12
	F.J. Orlich & Hnos LTDA. (El Marqués)	52,444.58	36,260.78

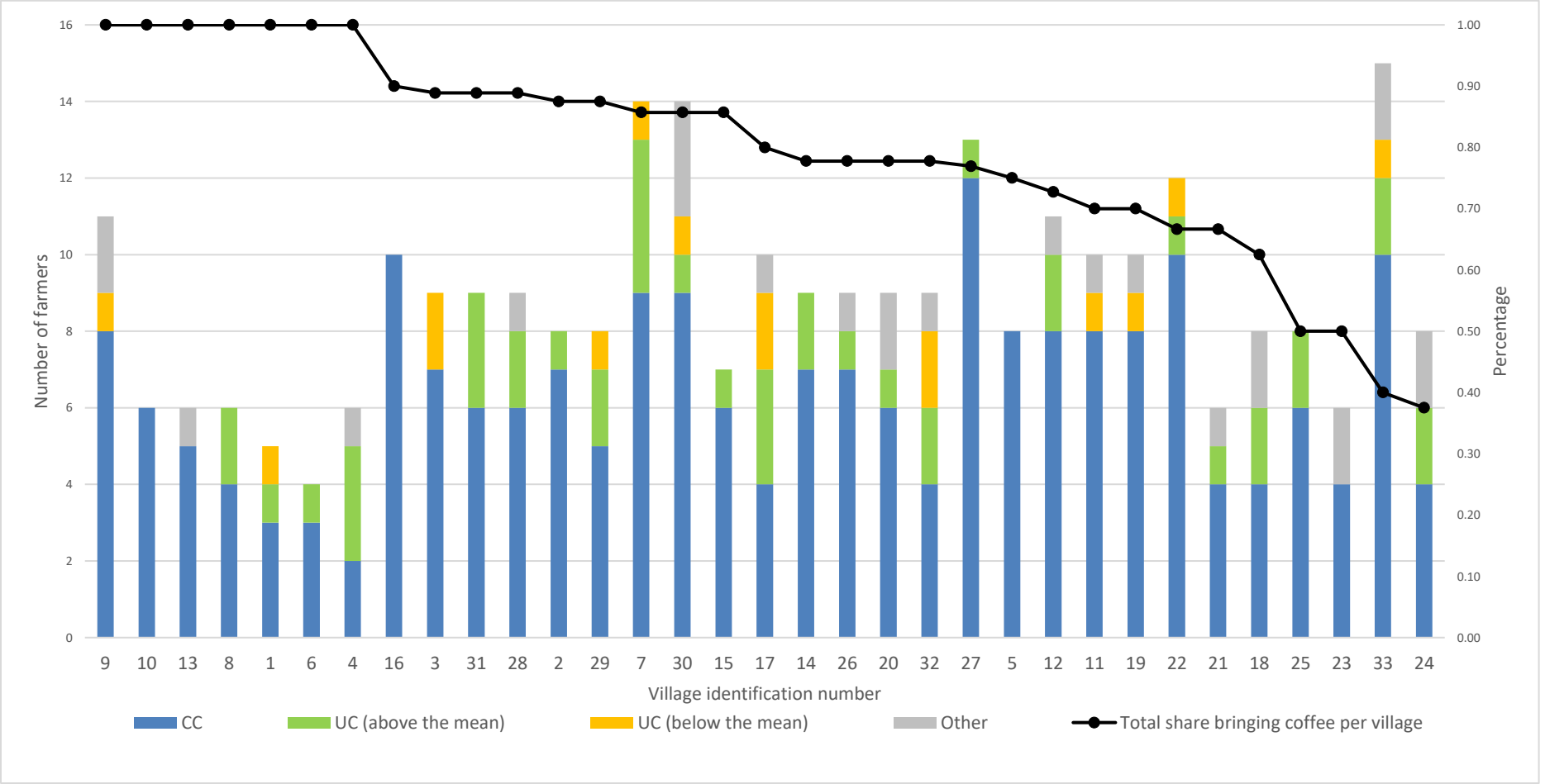
Notes: Prices in Costa Rican Colones (CRC). The final price is published before the harvest season and includes a 9% from the final liquidation price in favor of the coffee mill for the processing and marketing of coffee (MAG 2016) in accordance with the provisions of Law 2762 of June 21, 1961 on the regime of relations between producers, mills and coffee exporters. The Costa Rican Institute of Coffee (ICAFE) communicates to the interested parties the final liquidation prices of the coffee delivered to each mill.
Source: (ICAFE 2014).

Annex 2. Payments distributed through the year in Coope Tarrazú

Harvest period	Advancement	Adjustment		Official liquidation price	Final liquidation price
		Amount in colones	Date of payment		
2012-2013	58,000	3,000	July		
		3,000	August		
		3,000	September		
		3,000	November		
		500	December	62,983.00	70,500.00
2013-2014		5000	September		
		5000	October		
		160	December	**69,646.40**	75,160.00

Source: CoopeTarrazú (2018) Note: In addition, the associate contributes 2% per fanega (coffee measurement unit that is approx. 250 kg) as a contribution to the capital of the cooperative. The amount collected over the years is returned when the associate retires or is delivered to the family when she/he dies.

Annex 3. Distribution of farmers' social preferences per village and participation in agricultural cooperatives.



Annex 4. Public Goods Game Instructions

In this game we are going to talk about "points." At the end of the game, the total amount of points you get will be converted to colones. Each point you get is equivalent to 200 colones.

1 point = 200 colones

You will play considering the decisions of two other peer farmers in the community, but you do not know who they are. Only the coordinators of the game know who they are and they are chosen at random.

We are going to read the instructions together and present some examples. Please consider the numbers in the example as an illustration. The points you will obtain from the game will be different. At the end of the instructions, we are going to ask you a few questions that will help you to understand the game.

BASIC DECISION

You are a member of a group of three farmers. Each of you has to decide how to divide 20 points (20 points = 4000 colones) into two different accounts. You can put these 20 points in your private account, or you can invest them fully or partially into a project. Each point you do not invest in the project will automatically be transferred to your private account.

INCOME FROM THE PRIVATE ACCOUNT

For each point you put in your private account, you will earn exactly one point. For example, if you put twenty points on your private account (which implies that you do not invest anything in the project), you will earn exactly twenty points from the private account. If you put 6 points into the private account, you will receive an income of 6 points from the private account. Nobody except you earns something from your private account.

INCOME FROM THE PROJECT ACCOUNT

For each point you deposit into the project account, all members of the group receive the same income. That is, you will also earn income for the points that the other two farmers deposit into the project account. However, you do not know how many points that will be. The coordinators will collect the information from the other farmers and will notify me of the result when making payments at the end of the game.

For each member of the group, the income from the project account will be determined as the sum of the contributions of the three farmers multiplied by 0.5.

Project account income = the sum of the contributions of the 3 x 0.5

For example, if the sum of the three contributions to the project account is 60 points, you and the other people in the group will receive ➔ 60 x 0.5 = 30

Another example, if the three farmers in the group deposit a total of 10 points, then you and all the others receive ➔ 10 x 0.5 = 5

YOUR TOTAL INCOME

Your total income is the sum of your income from the private account and your income from the project account.

Income from the private account	➔	*20 points from your initial endowment*
		–
		Your contribution to the project
		+
Income from the project account	➔	*Sum of all contributions to the project x 0.5*
		Total income

CONTROL QUESTIONS
Of the 20 points available, suppose that no one, including you, puts points in the project account. Then…

- What is your total income? **R /** 20 points from the personal account
- What is the income of the other people in your group? **R /** Equal

Of the 20 points available, let's assume that everyone, including you, puts all the points in the project account. Then…

- What is your total income? **R /** 20 + 20 + 20 = 60 x 0.5 = 30
- What is the income of the other three people in your group? **R /** Equal

(Check farmers' responses to the control questions. If they do not give a correct answer, repeat the explanation from the basic decision.)

These are the extreme cases (all or nothing), but you and the other farmers in the group can decide how you want to distribute the points in any way.

Remember that what you leave in your personal account is yours. What you put into the project account will be returned to you according to the sum of the contributions of each farmer in your group.

UNCONDITIONAL CONTRIBUTION *(Show decision sheet 1)*
In the unconditional contribution, you must decide how many of the points you deposit into the project account. You must write a whole number that cannot be less than zero or greater than the 20 points you have to distribute. The rest of the points will go to your personal account.

CONDITIONAL CONTRIBUTION *(Show decision sheet 2)*
Your second task is to complete the table of contributions. You should indicate for each possible average contribution of the other two people in the group the number of points that you want to put in the project account.

The average contribution is the sum of the contributions of the other two producers divided by two.

- Example 1: the other two farmers contribute (20 + 20 = 40 ÷ 2 = 20)
- Example 2: the other two farmers contribute (5 + 5 = 10 ÷ 2 = 5)
- Example 3: the other two farmers contribute (5 + 20 = 25 ÷ 2 = 12.5 = 13). The nearest whole number would be used.

You have to write in the right column how many points you want to contribute to the project account given that the other farmers contribute on average (approximate) the number of points in the left column. That is, you will decide how much you want to contribute depending on what other people contribute.

After all the farmers have made their unconditional contribution and completed the table of contributions, one person from each group will be selected, and their income will be determined according to the table of contributions. For the other two farmers in the group, the income will be determined by the unconditional contribution. I will tell you if you were selected at the end of the games.

CONTRIBUTION OF OTHERS *(Show decision sheet 3)*
Now you will tell us how much you think the other two farmers of your group have written as their unconditional contributions. In other words, what number do you suspect they wrote on average?

If you correctly guess the average contribution of the other two farmers to the project account, you can earn additional points.

If the true unconditional contribution of others is equal to what you guessed, you will earn four extra points. If the real contribution is a point above or below, you earn three extra points. If the contribution is two points above or below, you earn one extra point.

Mark only one box with an X (single selection).

Annex 5. Decision sheet for unconditional contribution and final payment

Unconditional contribution

How many of the 20 tokens do you want to invest in the project? _____

(Number between 0 – 20)

Complete after receiving the information of the donations of the other members of the group: 1 point = 200 colones.

		Points	
Income from private account	➔	_____	
		+	
Income from the project account	➔	_____	
		+	
Income from guessing the contributions from the other farmers	➔	_____	
Total income	➔	_____	*x 200 = ¢* _____

Annex 6. Decision sheet for conditional contribution

Conditional contribution

Average contribution (approximate) of the other two farmers to the project account	Your contribution to the project account is:
0	
1	
2	
3	
4	
5	
6	
7	
8	
9	
10	
11	
12	
13	
14	
15	
16	
17	
18	
19	
20	

Annex 7. Decision sheet for guessed contribution

Guessing contributions

Average contribution (approximate) of the other two farmers to the project account	Mark with an **X** the box that you think corresponds to what the other two farmers contributed unconditionally to the project account. (JUST CHECK ONE BOX)
0	
1	
2	
3	
4	
5	
6	
7	
8	
9	
10	
11	
12	
13	
14	
15	
16	
17	
18	
19	
20	