Do better monitoring institutions increase leadership quality in community organizations? Evidence from Uganda
Supplementary Appendix

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Contents

Introduction

This appendix provides supplementary information for the analysis presented in the main text.

1 Theory

1.1 Proof of Proposition 1

Let,

$$g(m, e_l^*(m)) = -\frac{\partial I(A_i, 1-e_i)\alpha}{\partial e_i} + \frac{\partial P(A_i, e_i)(1-\alpha)}{\partial e_i} - \frac{\partial C(m, e_i)}{\partial e_i} = 0.$$

Applying the implicit function theorem, we have,

$$\frac{de_l^*}{dm} = \frac{-\partial g(m, e_l^*)/\partial m}{\partial g(m, e_l^*)/\partial e_l^*} = \frac{\frac{\partial^2 C(m, e_l^*)}{\partial e_l^* \partial m}}{\frac{\partial^2 I(A_l, 1-e_l^*)\alpha}{\partial e_l^{*2}} + \frac{\partial^2 P(A_l, e_l^*)(1-\alpha)}{\partial e_l^{*2}}}.$$

Given the functional form assumptions, the numerator in the expression above is positive while the denominator is negative, so the overall relationship is positive. If the same exercise is done for α rather than m, the numerator we obtain is,

$$-\frac{\partial I(A_i, 1-e_i)}{\partial e_i} + \frac{\partial P(A_i, e_i)}{\partial e_i} > 0,$$

so overall we find $\partial e_l^*/\partial \alpha < 0$.

1.2 Proof of Proposition 2

Two conditions must hold to prove this Proposition. First, we need. $dCP_i(A_i, \alpha, m)/dm < 0$. Taking this derivative, we have the following.

$$\frac{dCP_i(A_i, \alpha, m)}{dm} = -\frac{\partial C(m, e_i^*)}{\partial m} < 0$$

Second, we need $\lim_{m \to +\infty} CP_i(A_i, \alpha, m) < 0$. This must hold given the result above and the weak convexity of $C(m, e)$ with respect to m. These two results, together with the continuity of the $CP_i(A_i, \alpha, m)$ function imply that as m increases eventually a monitoring level $\bar{m}_i$ is reached at which $CP_i(A_i, \alpha, \bar{m}_i) = 0$ and any further increases in m result in $CP_i(A_i, \alpha, m) < 0$.

1.3 Proof of Proposition 3

We have two members with $A_i > A_j$. Under Condition 1, this implies that $CP_i(A_i, \alpha, m) < CP_j(A_j, \alpha, m)$ Suppose that $m = \bar{m}_i$ is such that $CP_i(A_i, \alpha, m) = 0$. This implies that $CP_j(A_j, \alpha, m) > 0$. Given Prop. 2, it must be the case that $\bar{m}_i < \bar{m}_j$.

1.4 Proof of Proposition 4

This proof requires two steps. First, we need to show that dCP_i/dA_i is decreasing in α. To do this, we show that $d^2CP_i/dA_i d\alpha < 0$. The second step involves showing that there exists some $\bar{\alpha} \in (0, 1)$ such that $dCP_i(A_i, \bar{\alpha}, m)/dA_i \leq 0$ for all m.

Step 1

We start with,

$$\frac{dCP_i}{dA_i} = \frac{\partial I(A_i, 1 - e_i^*)\alpha}{\partial A_i} + \frac{\partial P(A_i, e_i^*)(1 - \alpha)}{\partial A_i} - \frac{\partial I(A_i, 1)\alpha}{\partial A_i} + \left(\frac{\partial I(A_i, 1 - e_i^*)\alpha}{\partial e_i^*} + \frac{\partial P(A_i, e_i^*)(1 - \alpha)}{\partial e_i^*} - \frac{\partial C(m, e_i^*)}{\partial e_i^*} \right) \Big($$

Using Equation 3, this simplifies.

$$\frac{dCP_i}{dA_i} = \frac{\partial I(A_i, 1 - e_i^*)\alpha}{\partial A_i} + \frac{\partial P(A_i, e_i^*)(1 - \alpha)}{\partial A_i} - \frac{\partial I(A_i, 1)\alpha}{\partial A_i}$$

Taking the derivative with respect to α, we obtain the following.

$$\frac{d^2CP_i}{dA_i d\alpha} = \left[\frac{\partial I(A_i, 1 - e_i^*)}{\partial A_i} - \frac{\partial I(A_i, 1)}{\partial A_i} \right] + \left[\frac{\partial^2 I(A_i, 1 - e_i^*)}{\partial e_i^* \, \partial A_i}\alpha + \frac{\partial^2 P(A_i, e_i^*)}{\partial e_i^* \, \partial A_i}(1 - \alpha) \right] \frac{de_i^*}{d\alpha}$$

Note that $de_i^*/d\alpha < 0$, $\partial^2 I(A_i, 1 - e_i^*)/\partial A_i \partial e_i^* < 0$, and $\partial^2 P(A_i, e_i^*)/\partial A_i \partial e_i^* > 0$. Thus, all terms are negative except $(\partial^2 I(A_i, 1 - e_i^*)/\partial A_i \partial e_i^*)(de_i^*/d\alpha) > 0$. Denote $-de_i^*/d\alpha = \Delta > 0$. We rewrite the equation above by splitting the first term into two.

$$\begin{aligned} \frac{d^2CP_i}{dA_i d\alpha} &= \left[\frac{\partial I(A_i, 1 - e_i^*)}{\partial A_i} - \frac{\partial I(A_i, 1 - e_i^* + \Delta)}{\partial A_i} \right] + \left[\frac{\partial I(A_i, 1 - e_i^* + \Delta)}{\partial A_i} - \frac{\partial I(A_i, 1)}{\partial A_i} \right] \\ &- \left[\frac{\partial^2 I(A_i, 1 - e_i^*)}{\partial e_i^* \, \partial A_i}\alpha + \frac{\partial^2 P(A_i, e_i^*)}{\partial e_i^* \, \partial A_i}(1 - \alpha) \right] \Delta \end{aligned}$$

Next, we take a linear approximation of the first term on the right-hand side.

$$
\begin{aligned}
\frac{d^2CP_i}{dA_i d\alpha} &\approx \Delta\frac{\partial^2 I(A_i,1-e_i^*)}{\partial A_i \partial e_i^*} + \left[\frac{\partial I(A_i,1-e_i^*+\Delta)}{\partial A_i} - \frac{\partial I(A_i,1)}{\partial A_i}\right] \\
&- \left[\frac{\partial^2 I(A_i,1-e_i^*)}{\partial e_i^* \, \partial A_i}\alpha + \frac{\partial^2 P(A_i,e_i^*)}{\partial e_i^* \, \partial A_i}(1-\alpha)\right]\Delta
\end{aligned}
$$

Rewriting,

$$
\begin{aligned}
\frac{d^2CP_i}{dA_i d\alpha} &\approx \left[\Delta\left(\frac{\partial^2 I(A_i,1-e_i^*)}{\partial A_i \partial e_i^*}\right) - \Delta\left(\frac{\partial^2 I(A_i,1-e_i^*)}{\partial A_i \partial e_i^*}\right)\right]\alpha \\
&+ \left[\Delta\left(\frac{\partial^2 I(A_i,1-e_i^*)}{\partial A_i \partial e_i^*}\right) - \Delta\left(\frac{\partial^2 P(A_i,e_i^*)}{\partial e_i^* \, \partial A_i}\right)\right](1-\alpha) \\
&+ \left[\frac{\partial I(A_i,1-e_i^*+\Delta)}{\partial A_i} - \frac{\partial I(A_i,1)}{\partial A_i}\right] < 0
\end{aligned}
$$

Step 2

We are looking for an $\bar{\alpha}$ such that $dCP_i/dA_i \leq 0$ for all values of m. To begin, set $dCP_i/dA_i = 0$ to get a cutoff $\bar{\alpha}(m)$ given a particular monitoring level m.

$$
\bar{\alpha}(m)\left(\frac{\partial I(A_i,1-e_i^*)}{\partial A_i} - \frac{\partial I(A_i,1)}{\partial A_i}\right) + \left(\frac{\partial P(A_i,e_i^*)}{\partial A_i}\right)(1-\bar{\alpha}(m)) = 0
$$

Applying the implicit function theorem to this formula, we can show that $d\bar{\alpha}(m)/dm > 0$. Thus, we need to find $\bar{\alpha} = lim_{m\to+\infty}\bar{\alpha}(m)$. As $m \to +\infty$, $e_i^* \to 1$. Thus, the $\bar{\alpha} \in (0,1)$ which satisfies $dCP_i/dA_i \leq 0$ for all m is implicitly defined by the following equation.

$$
\bar{\alpha}\left(\frac{\partial I(A_i,1)}{\partial A_i}\right) = \left(\frac{\partial P(A_i,1)}{\partial A_i}\right)(1-\bar{\alpha})
$$

1.5 Choice of the citizen-candidate framework

The theory presented in this paper is built on the citizen-candidate framework. One of the primitives of this approach is that there is a fixed institutional framework (constitution) under which the political process plays out. One way that this approach is reflected in our model is by the function $C(m, e_l)$ that specifies the direct costs and rewards of being the leader given some exogenous level of monitoring institutions m, in which we have assumed that $C(m, e_l)$ is increasing in m. The groups take these structures as given, and the political process plays out within this system. Note that this function includes a fixed level of remuneration paid to the group leader. However, it does not allow this remuneration level to vary with m.

An alternative to this approach is to think of the groups as generating a new contract for the leader, as in a standard principal-agent framework. In this approach, the groups actively seek to offer an optimal contract that allows them to maximize some group objective function. This approach is fundamentally different from the citizen-candidate approach we have chosen. The main difference is that it requires the assumption that the group is able to act effectively as a principal when designing the contract for the group leader. We view this assumption as unrealistic. In democratic organizations, such as the one we study, generating a contract requires that there be a leader, or group of leaders, who write the contract. This is different from, say, a firm, in which one or more owners can design a contract for their employees. Thus, the group leaders would themselves be required to generate the contract offered to the group leaders. They would, in effect, be acting simultaneously as the principal and the agent, which is likely to be an unworkable situation.

One result of this feature of democratic organizations is that the political process often plays out under constitutions that change very slowly, even if those constitutions may be suboptimal at any point in time. The difficulty involved in making changes to these structures is likely to reduce the ability of current leaders to manipulate the system to their advantage. We believe that the citizen-candidate framework provides a more realistic approach when dealing with these types of democratic organizations.

One way to test this intuition is to look at the theoretical implications of different approaches and compare them to our empirical results. In the following analysis, we consider the possibility that groups are able to make ex ante adjustments to the wage paid to the leader. We show that this may lead to a case in which $C(m, e_l)$ is decreasing in m. We then describe the predictions obtained under such an assumption and compare these predictions to the empirical findings. We find that $C(m, e_l)$ decreasing in m yields predictions which do not match the empirical evidence, providing additional support for our assumption that $C(m, e_l)$ is increasing in m.

Suppose that groups can choose to adjust the leaders wage ex ante, taking into account the monitoring institutions. Then groups with higher monitoring levels may choose to set a higher wage, offsetting the additional cost that the leader faces due to a higher level of monitoring by the group. To see why groups may want to do this, suppose that groups maximize some value function over the public good, given by $V(A_l, e_l^*) - w$ where $w \geq 0$ is the wage paid to the leader. This function is increasing in both leader effort and leader ability, and these inputs are complements in public goods production, so that $\partial^2 V(A_l, e_l)/\partial A_l \partial e_l > 0$.

Now suppose that the group is considering paying a higher wage in order to induce a member with ability A_1 to become a candidate, while if no wage is paid the group ends up with a leader with ability A_0, where $A_0 < A_1$. The benefit to the group of paying this additional wage is,

$$V(A_1, e_1^*) - V(A_0, e_0^*).$$

The additional cost that the group must pay in order to induce the member with ability A_1 to become a candidate is,

$$w = I(A_1, 1)\alpha - I(A_1, 1 - e_1^*)\alpha - P(A_1, e_1^*)(1 - \alpha) + C(m, e_1^*) + \phi.$$

Next, consider how these costs and benefits are affected by a change in the level of monitoring. The impact of an increase in m on the wage that must be paid is given by,

$$\frac{\partial w}{\partial m} = \left.\frac{\partial C(m, e_l)}{\partial m}\right|_{e_l = e_1^*} > 0.$$

As the monitoring level increases, groups will need to offer a higher wage in order to induce the higher ability group members to become candidates. The impact of an increase in m on the benefits of obtaining the higher ability leader is,

$$\left.\frac{\partial V(A_1, e_l)}{\partial e_l}\right|_{e_l = e_1^*} \left.\frac{de_l}{dm}\right|_{e_l = e_1^*} - \left.\frac{\partial V(A_0, e_l)}{\partial e_l}\right|_{e_l = e_0^*} \left.\frac{de_l}{dm}\right|_{e_l = e_0^*}.$$

It is not clear whether the benefits of paying the additional wage are increasing in m, but this is a possibility depending on the exact functional forms. If the benefits of paying the additional wage are strong enough, then an increase in m may induce a wage increase which is large enough to more than offset the additional cost to the leader of the higher monitoring level. In this case, we may have a function $C(m, e_l)$ which is decreasing in m (recall that the leader's wage is included in $C(m, e_l)$).

What does the theory predict in a case in which $C(m, e_l)$ is decreasing in m? One effect of this difference is to overturn Proposition 2. Now it is no longer the case that an increase in the level of monitoring will drive high ability individuals out of the candidacy pool. In fact, with $C(m, e_l)$ decreasing in m, we would have $dCP/dm > 0$. When Condition 1 holds, this would lead to high ability members being more likely to opt out of the candidate pool when m is low. This prediction runs counter to our empirical results, suggesting that a theory which predicts $C(m, e_l)$ decreasing in m does not provide a satisfactory description of the patterns we observe.

1.6 Incentive Mechanism

This subsection argues that, when there is a great deal of uncertainty regarding the value of the public good produced, an incentive scheme based on leader's effort will be preferred to one based on the public good value. The driving force behind this idea is that members are risk averse. Compensating the leader based on the public good value forces him to accept additional uncertainty in his utility function, reducing the utility that he derives from being the leader. Compensation based on effort, which is more easily observed, avoids the disutility generated by this additional uncertainty. This advantage must be weighed against the fact that compensation based on the value of the public good allows higher ability members to exert less effort than lower ability member and still receive the same costs or benefits from holding office. This reduces the opportunity cost of holding office for high ability members, relative to low ability members, increasing the chances of high ability members choosing to become candidates. These issues have been analyzed by a number of previous authors, such as Lazear (1986) and Baker (2000), and so we only revisit them briefly here.

Consider two incentive schemes. The first is based on effort and denoted $C_1(m, e_i)$. The second is based on the public good value and denoted $C_2(P(A_i, e_i, \eta_P))$. The utilities of the leader under an effort-based and output-based performance scheme, respectively, are given below.

$$U_1 = U[I(A_l, 1 - e_l, \eta_I)\alpha + P(A_l, e_l, \eta_P)(1 - \alpha) - C_1(m, e_l) - \phi]$$

$$U_2 = U[I(A_l, 1 - e_l, \eta_I)\alpha + P(A_l, e_l, \eta_P)(1 - \alpha) - C_2(P(A_l, e_l, \eta_P)) - \phi]$$

Now consider the effect of an increase in the variance of η_P (with a commensurate increase in the variance of η_I). The effect on the utility through the first and second terms inside the U() function will be equivalent regardless of the incentive scheme, all else equal. However, an increase in the variance of η_P will also act through $C_2(P(A_l, e_l, \eta_P))$ under the output-based incentive scheme, which will cause U_2 to decrease more rapidly in η_P than U_1. Thus, if there is sufficient uncertainty in the value of the public good, the returns to being a leader may be lower under an output-based incentive scheme than under an effort-based incentive scheme. This would motivate groups to offer effort-based incentive schemes, such as the scheme posited in this paper.

1.7 Monitoring Mechanism

The monitoring technology in this theory can be motivated as follows. Suppose that there is a set of T tasks that the group leader should fulfill. If the leader allocates an effort level $e_l^* \in [0, 1]$ to the leadership position, then a fraction e_l^* of these tasks are completed, while $1 - e_l^*$ of them remain undone. The monitoring technology $m \in [0, T]$ allows the group to look at m of these tasks and observe whether they were completed. The leader is then punished based on the number of tasks identified that are incomplete. If we consider a large number of tasks then this is equivalent to a variable with a binomial distribution, where the probability of identifying an incomplete task, per observation, is $1 - e_l^*$ and m gives the number of observations obtained. The expected number of incomplete tasks observed is then $m(1 - e_l^*)$ with variance $me_l^*(1 - e_l^*)$.

In order to simplify the model it is helpful to modify the framework above to eliminate the uncertainty. One way to do this is to assume that the expected value is always achieved, i.e., that the group always observes $m(1-e_l^*)$ incomplete tasks given an effort allocation e_l^* and monitoring level m. This simplification allows us to ignore the impact of the member's risk aversion on their effort allocation, greatly simplifying the analysis. Note that the resulting function $C(m, e_l^*)$ satisfies the model assumptions.

1.8 Simulations

To illustrate the forces at work in the model, we undertake a set of simulation exercises (details available below). Figures 1 and 2 show, respectively, the average level of leaders' effort and ability as a function of monitoring, for various levels of private income opportunities. Figure 1 demonstrates the *discipline effect:* an increase in monitoring increases the amount of effort exerted by the leader. Figure 2 demonstrates the *self-selection effect:* as monitoring increases, the expected ability of the leader decreases. This effect binds earlier at higher levels of private income opportunities. Figure 3 shows the result of these combined effects on the value of the public good. There is a clear inverted U-shaped relationship between monitoring and public goods value. Whereas the discipline effect dominates at lower monitoring levels, the self-selection effect dominates at higher levels. The higher the private income opportunities, the earlier this inflection point is reached. However, at low levels of private income opportunities the self-selection effect disappears. In this case, high-ability members prefer to run and they exert a high level of effort once elected.

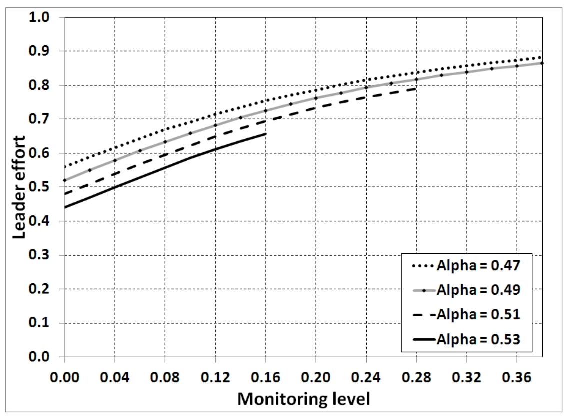

Figure 1: Simulated Leader Effort and Ability

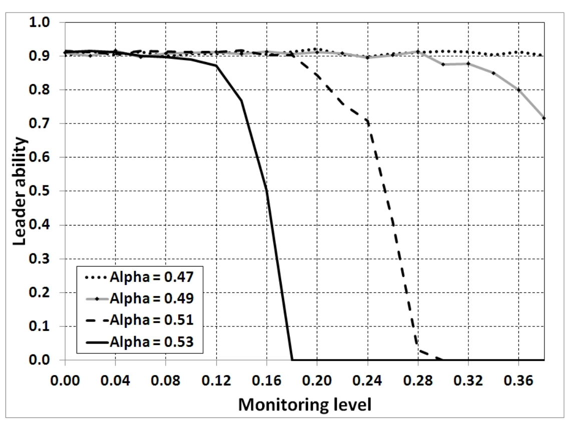

Figure 2: Simulated Leader Effort and Ability

The simulation results are generated by generating groups of 10 members whose abilities are

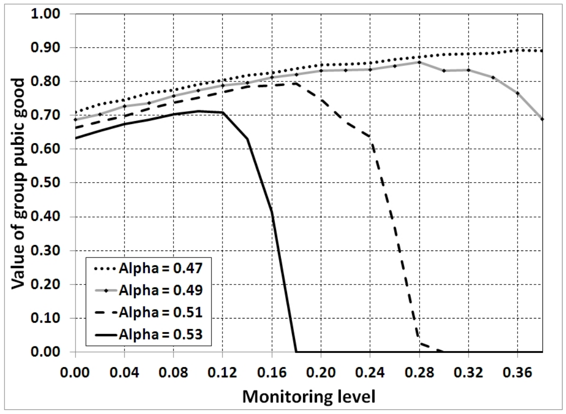

Figure 3: Simulated Public Good Values

drawn from a uniform [0,1] distribution. We then use the model to derive the candidate pool, identify the leader, and calculate the public good value obtained by each group. We repeat this procedure 200 times for each set of parameter values. When there are multiple equilibria, the results presented in the main text focus on the equilibrium delivering the highest possible public good value.

The functional forms and parameter values used are consistent with the model's assumptions and allow us to display a range of possible scenarios. The following functional forms are used in the simulation exercise.

$$I = A_i^{\beta}(1-e_i)^{1-\beta} \qquad P = p * A_i^{\beta} e_i^{1-\beta} \qquad C = m(1-e_i)$$

The parameter values used for the simulations are $N = 10$, $\beta = .5$, $\phi = .1$, and $p = .1$. The simulations are run for values of m from 0 to 0.4 by steps of .02 and for $\alpha = \{0.47, 0.49, 0.51, 0.53\}$.

Figure 1.8 presents additional results from the simulation exercise. The data are constructed by ranking the individuals in each group by their ability, with 10 being the highest and 1 being the lowest ability member. It shows the ranking of the member that ultimately becomes the leader. The main point here is that not only is leader ability falling, but that it is falling even though higher ability members are available.

We also calculate results in which we take average values over all equilibria, rather than just the equilibrium that delivers the best manager, for each set of parameter values. The average leader effort, leader ability, and public good value produced are displayed in Figures 5 and 6 below. These show the same results as obtained when we focused only on the best available equilibrium. Note that in some cases there will be a single equilibrium and that under these conditions these results will be exactly the same as those displayed in Figures 1 and 2 in the main text.

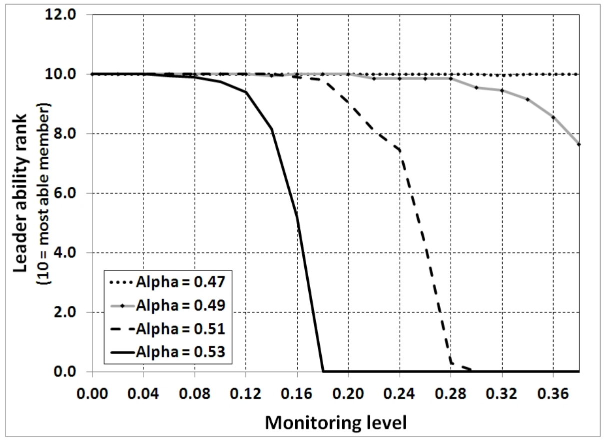

Figure 4: Simulated Leader Ability Rank

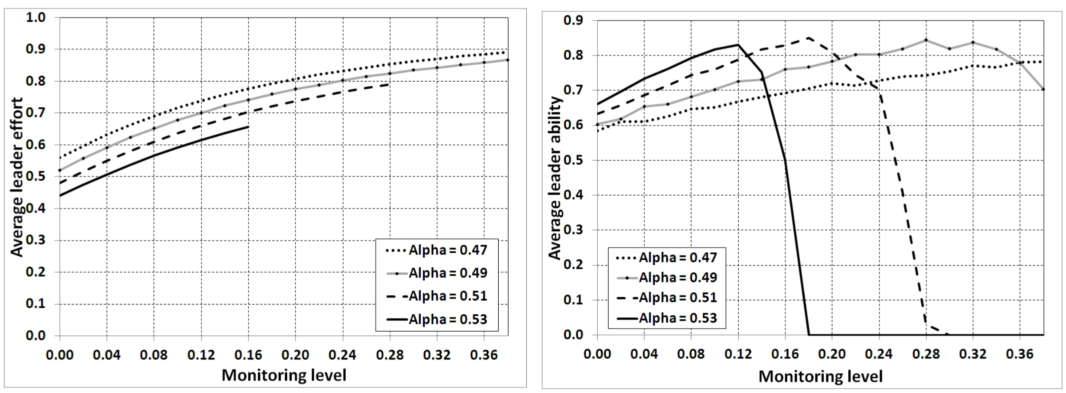

Figure 5: Simulated Leader Effort and Ability Averaged Over All Equilibria

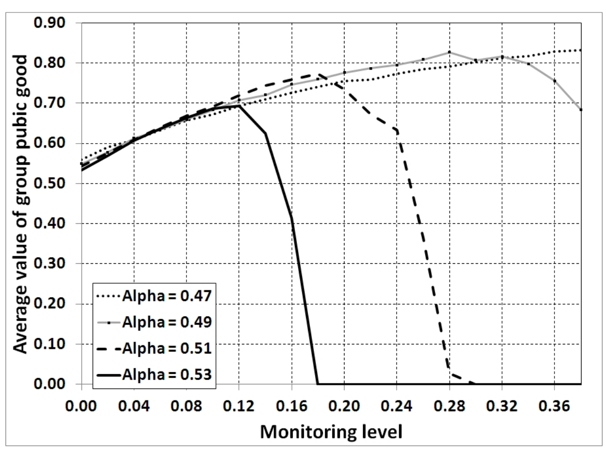

Figure 6: Simulated Public Good Value Averaged Over All Equilibria

2 Empirical setting and data appendix

2.1 Sampling design

This section briefly describes the sampling scheme used in this paper. To reduce crop-related variability, we limited the target population to only those associations that marketed the same crop. Coffee was selected since it was the most common cash crop marketed by the APEP groups. Limiting the sample to coffee reduced the universe of farmer cooperatives in about half: from 204 to 113. An additional 8 DCs were excluded due to the following: we excluded 2 associations from Bugiri because coffee turned to be very peripheral in that district. We further excluded 5 associations from Busheni district because those groups were formed many years before APEP, and were not comparable in terms of their organizational capacity. Finally we excluded from our sample an association from Kamwenge because it was the single DC in that district and surveying it would have been logistically complicated and prohibitively expensive. Our final universe comprises of 105 coffee growing farmer associations, all created by APEP facilitators after 2005. Once the target population was chosen, we used a stratified, random, multistage cluster design to select our sample. A summary of the sample scheme is provided in Table 1 below.

Table 1: Sample Design

Step	Sampling Unit (SU)	Number of SUs	Sampling Method
1	Target Population	105 DCs	Coffee growers
2	District-area	5	Stratified – proportional to # of DCs in strata
3	Farmer Associations (DCs)	50	Unequal probability without replacement
4	Produce Organizations (POs)	6 per DC	Clustered – simple random sample.
5	Group members	36 per DC	Clustered – probab proportional to group size.
6	Potential Pool of Candidates	$\sim$ 28 per DC	No sample: Complete Network.

Step 1: Define Strata. Though our universe of farmer associations is spread over 9 districts, we grouped associations into 5 strata. Strata were defined by meaningful district-areas: neighboring districts that were covered by the same project field trainers and trading partners, and that share a dominant ethnicity and/or were historically part of the same district. Figure 7 presents a map showing the location of the sampled districts.

Step 2: Farmer Associations (DCs). Based on a power calculation performed on simulated data, we sampled 50 farmer associations. We used unequal probability sampling without replacement to sample associations within strata (proportional to their size). The number of associations that were sampled from each stratum was proportional to the number of associations in each strata. According to this scheme, each sampled associations is representative of its strata, without a need for weighting.

Step 3: Village-level Producer Organizations (POs). Prior to sampling group members, we used an independent random sample to select six producer organizations (or POs) from each association, for a total of 287 POs. In the few cases in which a farmer association had fewer than seven POs, all of its village-level groups were sampled.

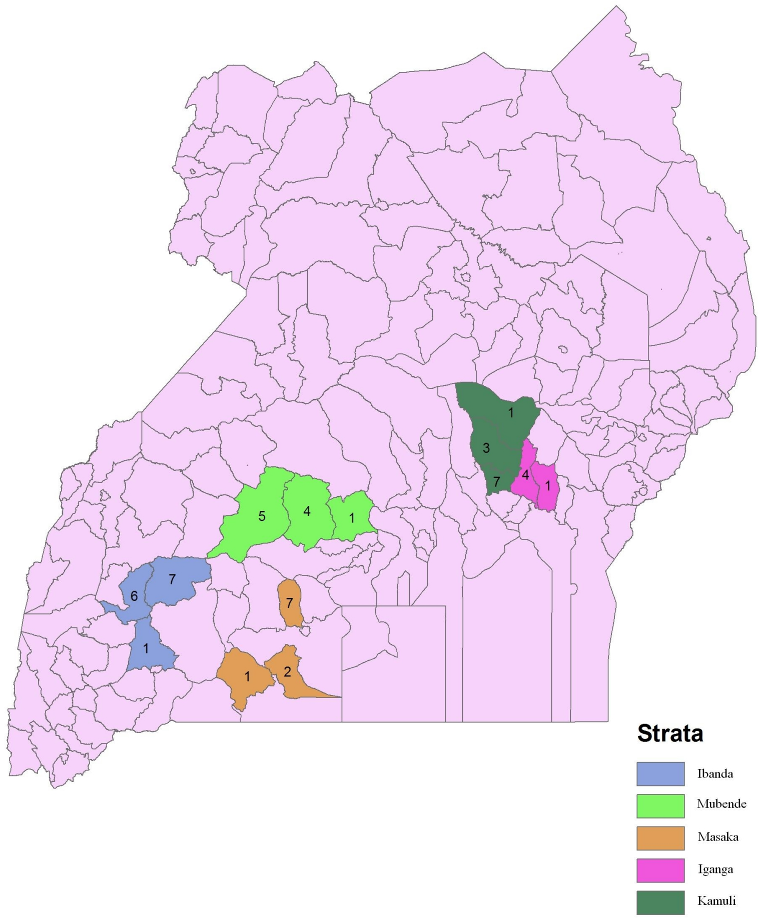

Figure 7: Colors indicate sample strata. Numbers indicate the number of farmer associations sampled within each strata and district.

Step 4: Group Members. We sampled 36 respondents from each farmer association. The number of sampled members from each of the six *sampled* village-level producer organizations was proportional to the size of the groups. This assured that the sample is self-weighted. Total sample size is thus 50 DCs X 6 POs X 6 members per PO = 1,800. We succeeded in surveying 1,781 out of the 1,800 sampled group members. We refer to this data source as the "members' survey".

Step 5: Relevant Pool of Potential Candidates: The DC board of directors, composed of all representatives from the PO groups, including those that become the leader, is the relevant pool of candidates for the leader's position. A significant effort was made to survey each of the DC board members. To keep the size of the relevant pool of candidates manageable, we adopted the following rule: when the number of groups in the DC was less than or equal to ten, we surveyed the PO chairperson, the two most active representatives from each farmer group, and any members holding DC executive positions (this includes the DC manager as well as a Chairperson, Secratary, and Treasurer). When the number of groups was larger, we invited only the PO chairperson plus the most active other PO representative, plus those members holding DC executive positions. For example, if a farmer association is comprised of eight village-level producer organizations, we surveyed 28 prominent members based on their position: 4 DC executives + 2x8 PO representatives + 8 PO chairmen). We visited each association up to four times to reduce the attrition rate, which was brought down to less than ten percent.

2.2 Data sources

We use four main data sources to construct the variables used in the empirical part of the paper: 1) Members' Survey; 2) Representatives' Survey; 3) PO questionnaire; and 4) DC questionnaire.

- **Members' Survey:** an individual-level survey with a random sample of group members who do not hold any leadership position in the association. Trained enumerators administered the members' surveys in a face-to-face interview, for a total of 1,781 surveys.
- **Representatives' Survey:** an individual level survey of leaders from both the village-level POs and the farmer associations. Trained enumerators administered the members' surveys in a face-to-face interview, for a total of 1,316 surveys.
- **PO questionnaire:** this questionnaire was administered to 3-4 leaders from each of the six sampled village producer organizations (POs), for a total of 287 group-questionnaires. These questionnaire had two parts. In the first part, PO leaders were asked to provide information at the group-level (e.g., the group's year of foundation, its number of members, etc.) At the second part, group leaders were asked to provide additional information on the group members using a complete list of members. This part included information such as the leader's assessment of the crop quality of each of the members, and whether members sold their coffee to middlemen.
- **DC questionnaire:** in each of the 50 sampled farmer associations, a trained enumerator interviewed the four DC executives together (DC manager, DC board chairperson, Treasurer, and Secretary). This questionnaire was designed to capture information at the association-level (e.g. DC year of creation, number of POs, identity of APEP trainer, rules and procedures, buyers information, etc.). In addition, the executives were asked to provide information on the marketing activities of the association using the DC's books and records.

2.3 Implementation

The survey instruments were piloted during the first two weeks in July 2009, and were translated to one of three local languages. Data was collected between late July 2009 and September 2009 by a group of 60 experienced local interviewers (enumerators), who administered all instruments in the native language of the respondents. Enumerators, who were hired directly by the PIs, were divided into three "language" teams. The eastern team covered 16 farmer associations in Iganga and Kamuli districts, where Basoga is the primary local language. The central team covered 20

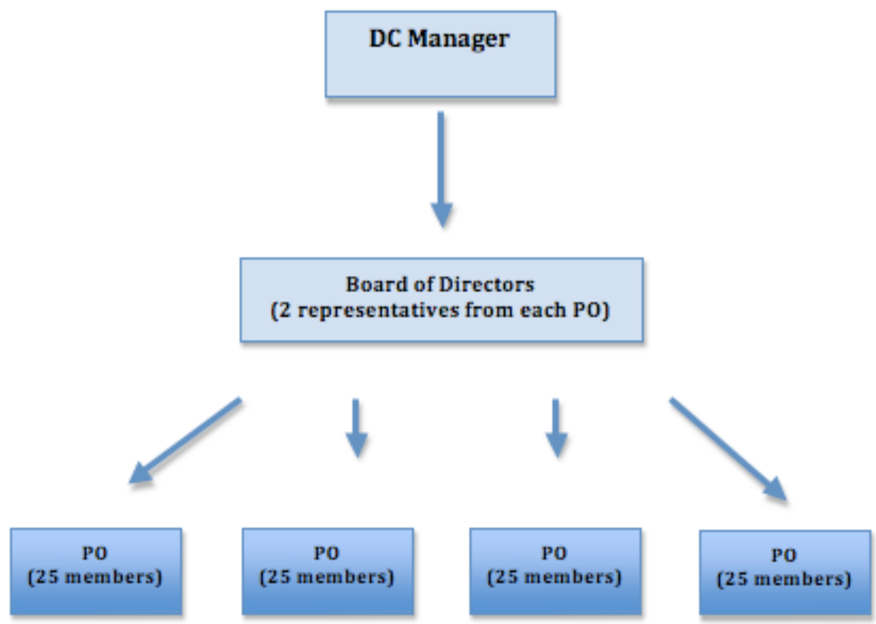

Figure 8: **Organizational structure.** This Figure presents the organizational structure of the APEP associations. Each farmer association (known as DC) is comprised of about 10 village-level producer organizations (POs), themselves comprised of about 20-25 members. Each of the POs that make up the association selects two representatives to serve on the DC council (also known as board of directors). The responsibilities of council representatives include, monitoring the work of the DC executives (including the manager), representing the opinions of PO members at the associational level, and transmitting information to and from their respective POs. The DC manager is the senior executive of the farmer association. His most important responsibilities include searching for buyers, negotiating input and output prices and organizing the collection of crops, including hiring and supervising employees. Additionally, DC managers help coordinate group activities, sanction 'defectors and facilitate the flow of information throughout the association.

DCs from Mubende, Mityana, Masaka and Rakai districts, where locals speak Luganda. Finally, the western team covered 14 DC from Kiruhura, Mbarara and Ibanda districts, where Ranyankole is the lingua franca. Enumerators went through training in class (4 days) and in a field setting (4 days). This also included training on human subjects issues and survey techniques. Enumerators were supervised by team leaders in a ratio of 1:5.

In each sampled association, data was collected in four rounds. First, an interviewer scheduled a meeting with the DC executives. In that meeting the interviewer introduced the study to the associations' leaders and asked for their cooperation. In addition, in that meeting s/he administered the DC-level questionnaire, and obtained a list of all DC council members. In the second day of enumeration, the research team conducted interviews with group representatives to the DC council and with the chairmen of all village-level groups, who were mobilized by the DC executives to a central location. In addition to individual-level interviews, leaders from each sampled village-group were asked to respond to a PO questionnaire, and to provide a complete list of all group members. Between the second and third round, the research team sampled 36 members from each sampled DC (including 8 replacements). Immediately after the sampling procedure, an interviewer travelled back to meet with the associations' leadership. In that meeting, the interviewer gave the DC leaders the list of sampled members and coordinated with them the next round of interviews. Once again, we relied on the DC leaders to mobilize the sampled members to a centralized location. In the third day of enumeration, individual-level interviews were conducted with the sampled members and with representatives who were not present in the previous day. Finally, the survey team traveled to each association for an additional day in order to reach sampled members or representatives who, for any reason, were not present in the main enumeration days.

2.4 Missing data

Great care was taken to reduce missingness. The research team administered association-level questionnaires in all 50 DCs, PO questionnaires in 287 out of 289 sampled village-level farmer groups. Out of a sample of 1,800 "ordinary" members (i.e. farmers with no leadership role) the research team managed to conduct individual-level surveys of 1,781 farmers. As for data in surveys that were missing at random (MAR), we used Patrick Royston's ICE multiple imputation package in Stata, which applies a chained equations approach. We imputed missing data only for some asset variables and demographic characteristics. We did not to impute data for farmers' activities as group members, such as marketing decisions, which were used to construct our key analysis variables.

2.5 Identification Strategy

Early on in the intervention, APEP hired field trainers, experienced extension agriculture officers, to assist neighboring villages to form larger federated associations (DCs). A 22-page manual that outlined the steps for establishing a DC informed the process of group formation, which took place during three workshops led by the field-trainers. The manual did not address, however, every aspect of group formation. Importantly, it did not detail explicitly the nature of some governance institutions such as the selection rule for the DC manager position or the organizations' level of monitoring. In personal interviews, field trainers explained that their recommendation of a specific governance institution was based on what *they* considered to be 'best practices' .

Our claim that groups' monitoring institutions are plausibly exogenous rests upon the following assumptions: (a) project field trainers played a pivotal role in establishing the community organizations; (b) almost all farmer associations followed their field trainer's recommendation of governance institutions; (c) the deployment of trainers was 'as-good-as-random' with respect to the trainers' recommendations; (d) APEP trainers' recommendations were based on personal preferences that are very likely orthogonal to characteristics of the groups; and (e) the facilitation process did not vary significantly, apart from the recommendation of governance institutions. Once established, groups, by and large, retained the recommended governance institutions, usually enshrined in constitutions.[1]

[1] All constitutions we examined had quorum and super-majority rules for making constitutional amendments. Lead-

The centrality of the trainers in the process of group formation (assumptions (a) and (b)) is attested to by the fact that all APEP groups, regardless of the trainer's identity, have a similar organizational structure and power division between the POs and the DC. Assumption (c) is based on the fact that the deployment of field-trainers was unrelated to their preferences of governance rules nor to their experience. Instead, the deployment of field trainers was influenced by proficiency in the local language, and by APEP's decision not to assign trainers to their district of residence to reduce the likelihood that they engage in income-generating activities unrelated the development project. Assumption (e) is based on the fact that due to the large area of coverage and the large number of villages assigned to each trainer, after group formation, the field-trainers had essentially no active role in the groups' activities.

We now turn to provide support to the plausibility of assumption (d). Had field-trainers conditioned their recommendation of governance rules on group characteristics, then (1) monitoring institutions would likely be correlated with, at least some, group covariates, and (2) field-trainers would be expected to make different recommendation to different groups. The data at hand is, however, not consistent with these predictions.

First, we regress a large set of group level covariates on groups' monitoring variables. Results, reported in Table 1 suggest that group monitoring institutions are orthogonal to group observable characteristics. Importantly, we also do not find that monitoring institutions are correlated with other governance institutions such as term limits or the method for selecting the DC manager (Table 1, panel 3).[2] Secondly, we examine the level of variability in the groups' monitoring level within and between field-trainers. Consider for example, the existence of a finance committee, which is a one of our proxy measures of monitoring. Table 2 demonstrates that almost always (47 DCs out of 50), groups created by the same trainer have also the same coding for the binary indicator of finance committee. This finding is consistent with the idea that field-trainers made recommendations based on what they view as 'best-practices' rather than adjusting recommendations to fit group characteristics. It also attests to the fact that groups, by and large, adopted their trainer's recommendation.

Finally we examine the distribution of the monitoring index by project trainers. If unobserved group characteristics were significantly impacting groups' monitoring institutions, then the variability of monitoring between groups *across* trainers should be quite similar to the variability of monitoring levels *within* field trainers. This, however, is not the case, as Figure 9 makes clear. In fact, the standard deviation in monitoring levels across facilitators (0.69) is almost two times larger than the standard deviation in monitoring within facilitators (0.39). This finding is consistent with our key identification assumption that monitoring institutions are, to a large degree, a function of the idiosyncratic preferences of field trainers that are independent of group characteristics.

ers' compensation can serve as a good example for the resilience of the DCs' governance institutions. When established, APEP facilitators encouraged new groups to keep monetary remuneration to leaders as low as possible. Our data confirms that 3-5 years after their creation, only one association paid its manager any regular salary.

[2]In about half of the DCs the manager is directly elected by the group member, and in the remaining DCs the manager is a pointed by the DC council. The correlation between the leader selection rule ('*Direct election*') and both audit committee (0.25) and finance committee (0.35) is relatively low. We, nonetheless, control for groups' leader selection rule in all our regressions.

COVARIATES BALANCE: MONITORING LEVEL

Monitoring measure:	Summary Index		Monitor assigned		Finance committee		Audit committee	
	Est	p-value	Est	p-value	Est	p-value	Est	p-value
Members covariates (sample)								
Male	-0.010	0.835	-0.026	0.892	0.008	0.889	-0.029	0.633
Age	-0.004	0.996	0.630	0.852	-0.393	0.791	-0.197	0.888
Education index	-0.031	0.840	0.462	0.226	-0.309	0.345	-0.246	0.523
Wealth index	0.033	0.504	0.229	0.384	0.009	0.930	-0.010	0.925
Church attendance	0.016	0.729	0.074	0.686	0.024	0.649	0.007	0.894
Born in village	-0.058	0.213	-0.202	0.321	-0.064	0.365	-0.074	0.263
Total land in Acres	1.131	0.534	4.663	0.574	-1.533	0.459	2.401	0.467
Years growing coffee	-0.767	0.674	-0.802	0.915	-2.634	0.347	-1.237	0.671
Council representatives covariates (complete set)								
Male	0.024	0.412	0.111	0.337	-0.004	0.885	0.029	0.598
Age	0.217	0.805	0.348	0.906	0.827	0.516	0.240	0.831
Education index	0.039	0.848	0.123	0.865	-0.217	0.418	0.186	0.555
Wealth index	-0.148	0.260	-0.624	0.575	0.102	0.790	-0.256	0.153
Church attendance	0.035	0.377	0.216	0.204	-0.029	0.313	0.024	0.572
Born in village	-0.080	0.218	-0.221	0.455	-0.112	0.145	-0.128	0.200
Total land in Acres	-1.001	0.752	-8.643	0.597	0.720	0.726	0.867	0.747
Years growing coffee	-0.314	0.883	1.670	0.849	-1.915	0.482	-1.283	0.667
DC covariates and 'Other' Governance Rules								
Age of DC	0.172	0.389	1.218	0.100	-0.114	0.769	0.003	0.991
Project years	-0.033	0.823	0.304	0.656	-0.020	0.944	-0.301	0.193
Term limits (chairperson)	0.087	0.200	0.261	0.290	0.109	0.307	0.131	0.436
Term limits (manager)	-0.022	0.642	-0.292	0.193	0.101	0.013	0.027	0.858
Direct elections	0.152	0.461	0.453	0.602	0.164	0.455	0.244	0.463
Sub-county covariates								
Education attainment	-0.004	0.682	-0.018	0.646	-0.003	0.804	-0.004	0.815
Literacy rate	-0.009	0.486	-0.008	0.857	-0.016	0.602	-0.021	0.436
Poverty head-count	0.124	0.953	4.854	0.629	-1.848	0.285	-1.497	0.498
Poverty gap	-0.121	0.907	0.259	0.951	-0.106	0.913	-0.575	0.677
Gini inequality index	-0.277	0.901	-2.397	0.779	0.197	0.923	0.246	0.945
Population density	-30.384	0.558	-107.196	0.609	-42.856	0.406	-34.200	0.685

Table 1: **Balance test of covariates across the measures of group monitoring.** Estimates and p-values are derived from a set of OLS regressions in which each of the group covariates is regressed on the group's monitoring, clustering standard errors by region (strata). Importantly, none of the group covariates is significant *notwithstanding the measure of monitoring used*. See text for information on the construction of the monitoring measures.

FINANCE COMMITTEE BY APEP FIELD TRAINER

APEP Field Trainer	Finance committee No	Yes	Total
Wilburforce Tibairira	5	0	5
David Baligindwire	0	6	6
George Atum	5	0	5
Vincent Okoth	7	0	7
Daniel Kambale	3	0	3
Edison Kawalya	0	4	4
Noa Kuluse	0	6	6
Elisa Tegyeza	4	2	6
Joseph Katto	7	1	8
Total	31	19	50

Table 2: **Finance Committee by APEP Field Trainer** Table provides information on the distribution of finance committees by APEP field trainers.

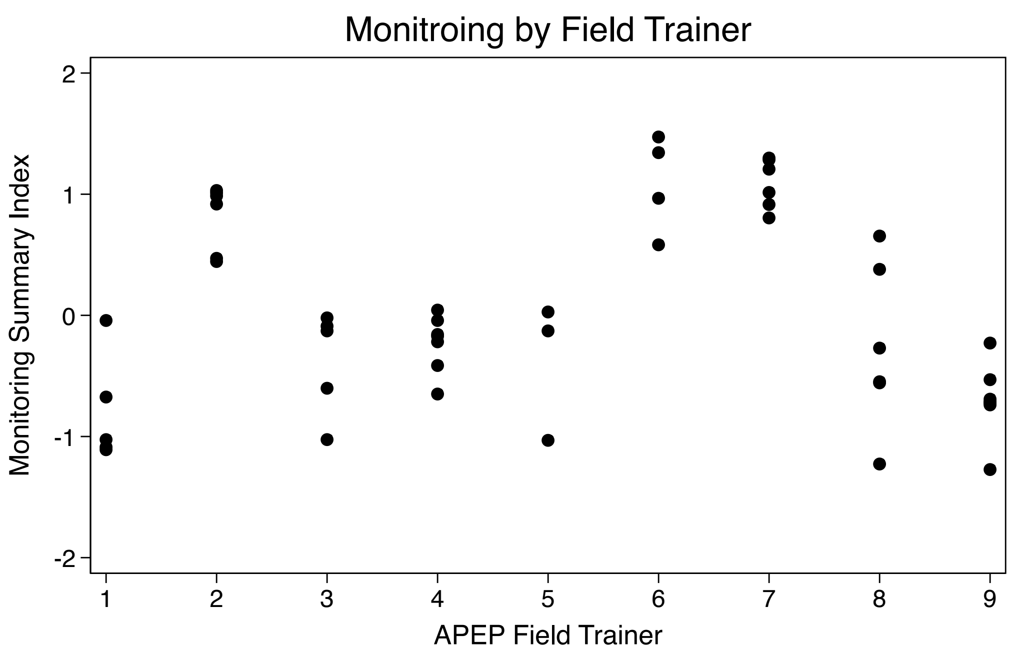

Figure 9: Monitoring Summary Index by APEP's nine field-trainers.

2.6 Additional figures

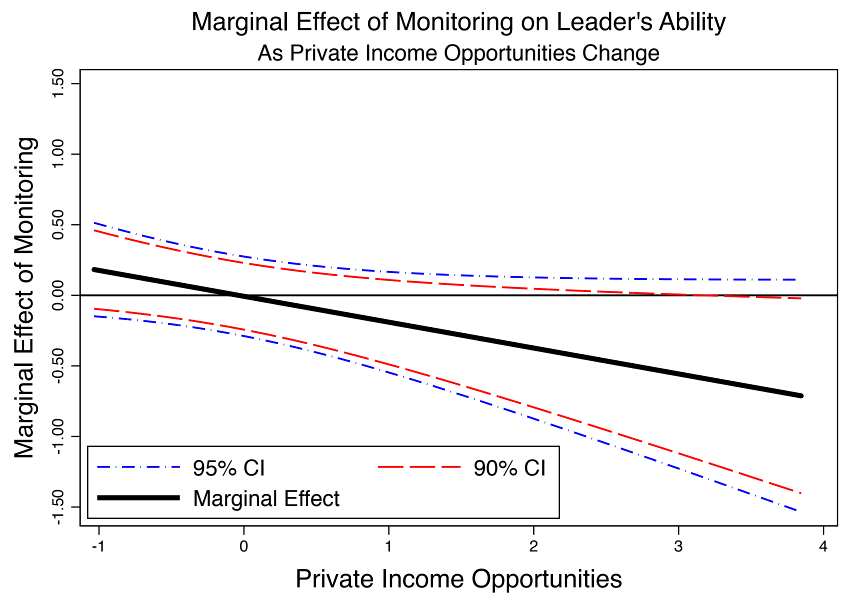

Figure 10: Monitoring effect on leader's ability as private income opportunities increase over its entire range ($n = 42$).

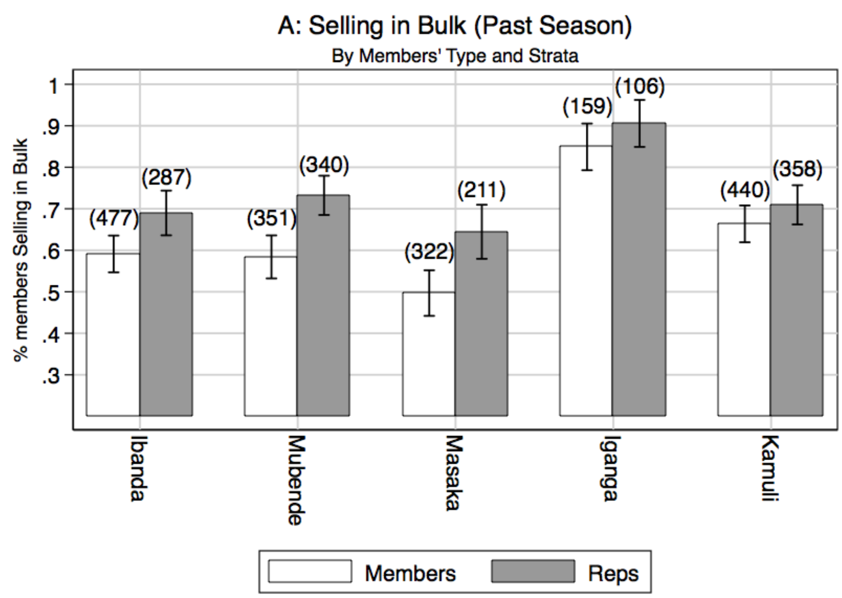

Figure 11: Proportion of respondents reporting that they sold coffee via their farmer group at least once in the past season, by type of member and region. Number of observations in parenthesis. Caps represent 95% CI.

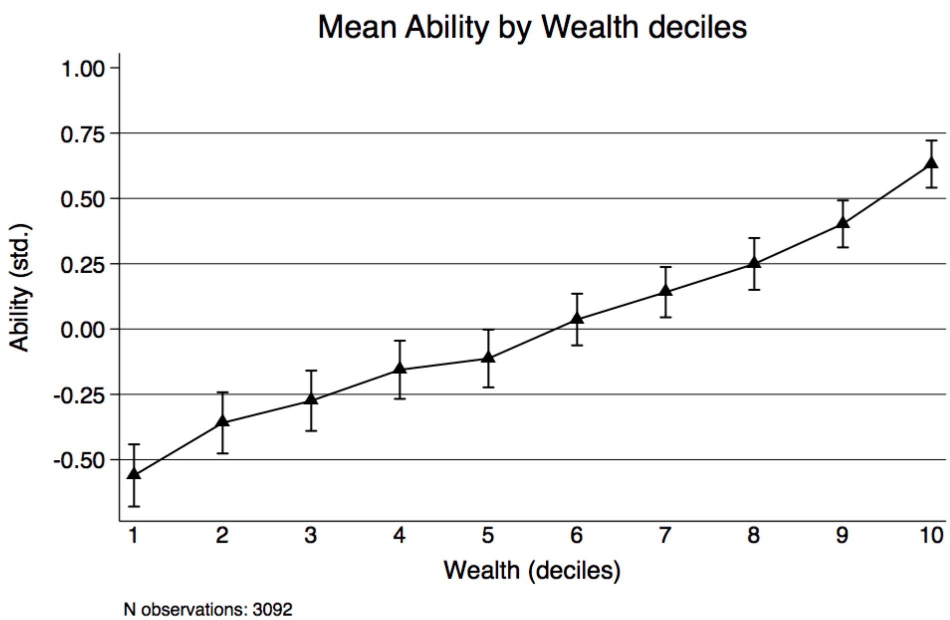

Figure 12: Relationship between wealth (deciles) and ability (std), for the entire sample (N=3092).

References

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