Matching in Rural Producer Organizations*

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Abstract

Using a rich dataset from West Africa we study the determinants of membership in rural producer organizations (RPO). We find that on average it is the more fortunate members of rural society who belong in RPOs. In Senegal, the dominant criteria are land ownership. In Burkina Faso it is economic status and family ties with village authorities. Ethnicity also plays a role: RPO membership is less likely for ethnic groups that traditionally emphasize livestock raising. We also look for evidence of assortative matching along multiple dimensions. To this effect we develop an original methodology based on dyadic regressions. We find robust evidence of assortative matching by physical and ethnic proximity as well as by wealth and social status.

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1 Introduction

Recent years have witnessed a renewed policy interest in community-based development (Mansuri and Rao 2004). This interest is predicated on the premise that community-based interventions can deliver more effective and equitable development.

In practice, community-based interventions in rural areas are often channeled through rural producer organizations (RPOs). Whether effective and equitable development can be achieved by assisting RPOs ultimately depends on their composition. If RPOs are composed primarily of local elites, interventions channelled through them are likely to reflect the preferences and interests of these elites.[1] Similarly, if RPOs form along gender or ethnic lines, their mode of operation is likely to reflect the interests of specific gender or ethnic groups. Knowing RPOs' composition is thus of interest to policy makers. Yet surprisingly little rigorous analysis has been devoted to this topic.[2]

This paper provides elements of answer using two large household surveys in Senegal and Burkina Faso, West Africa. There is a high prevalence of RPOs in both countries, with most villages having at least one and many villages having several. We examine the determinants of RPO membership. We proceed in two steps. First we investigate the factors that make certain types of households more likely to belong to an RPO. We also examine whether male and female membership in RPOs is affected by different determinants. This part of the analysis follows a standard regression approach in which households are the unit of analysis. We find that large, socially integrated households with a lot of land and a young head are more likely to belong to an RPO. Ethnicity also appears to play an important role: RPO membership is less likely for ethnic groups that traditionally emphasize livestock raising.

We then examine the data for evidence of assortative matching along multiple dimensions. This kind of study has traditionally been hindered by the fact that assortative criteria are often correlated. This makes inference difficult. To see why, suppose we find that members of the same RPO share a similar wealth level and a similar ethnicity. If ethnicity and wealth are correlated, univariate correlation analysis does not enable the researcher to decide whether

[1] A related issue is the purported problem of elite capture (Platteau and Gaspart 2003).

[2] There is a growing literature on factors influencing decision-making at the local level (Bardhan and Mookherjee 2006b), (Bardhan and Mookherjee 2006a), (Bardhan and Mookherjee 2005), (Besley, Pande, Rahman, and Rao 2004), (Besley and Coate 2003). But this literature focuses primarily on formal local institutions, for instance in Asia. No such analysis appears to have been conducted in Africa.

members of the same association share the same ethnicity because they sort on wealth, or whether they share the same wealth because they sort on ethnicity. What we need is a way to conduct multivariate analysis on assortative matching.

To this effect, we develop an original methodology that relies on dyadic regressions.[3] We construct the set of all possible pairs of households in each of the surveyed villages and investigate whether two households are more likely to belong to the same association if they resemble each other along various dimensions. Household and village characteristics are included as controls. Consistent robust inference is achieved by extending to dyadic regressions the White-Newey-West-Conley method of correcting standard errors. Unlike existing methods that rely on bootstrapping, this approach is easy to implement and capable of handling large datasets without excessive increase in computing time.[4]

Dyadic regression results by and large confirm the findings of the first batch of regressions: members of RPOs tend to be larger households with more land. They are also less likely to be headed by a woman. In Burkina we also find that households with more liquid wealth, close family ties with the village leadership, and a high self-assessed economic status are significantly more likely to belong to an RPO. These results suggest that, on average, RPOs are elitist organizations, particularly in Burkina.

We also find that, in both countries, households are more likely to belong to associations to which households residing nearby also belong, and with members of the same ethnic group. Geographical and social proximity thus seem to play important roles in the way RPOs are formed. We also find evidence of assortative matching on the size of the household and the gender of the household head. This means that large households tend to be found in organizations with large households – and vice versa – and that female-headed households are more likely to belong to organizations that include other female-headed households.

We find strong evidence of assortative matching by economic status: the rich and powerful are found in organizations with other rich and powerful households, and vice versa. The relevant dimensions of economic status vary somewhat between the two countries, however. In both countries the data provide evidence of sorting according to livestock ownership. The

[3] An estimating equation is said to be dyadic if each observation corresponds to a *pair* of individuals. Dyadic regressions are increasingly being used by sociologists and economists to study network formation (e.g. Snijders and Borgatti 1999, Sacerdote 2000, Fafchamps and Gubert 2006).

[4] A generalized least-square method has also been proposed to estimate dyadic models. The problem with this method is that, in the presence of heteroskedasticity, it yields inconsistent estimates.

strongest results are for sheep and goats – which constitute the most common form of liquid wealth in the Sahel (e.g. Fafchamps, Udry and Czukas 1998, Kazianga and Udry 2004). In Senegal, households are found to sort according to land ownership and education. Since many RPOs seek to assist agricultural production and market participation, the Senegal findings are not entirely surprising: households who join the same RPO tend to have similar land endowments and capacity to understand market incentives.

In contrast, we find that Burkinabe households sort on subjective economic status, social embeddedness, and age, with each variable playing an independent and significant role in assortative matching. What this means is that elders with close ties to the village chief and a high economic status in the village are found in organizations with others like them, while poorer, younger, less well-connected households are found in other organizations.

These results suggest that RPOs are elitist – especially so in Burkina Faso. We therefore suspect that they play a role in the reproduction of economic stratification. If external actors wish to achieve their stated goal of social justice, they must pay attention to the social and economic composition of the RPOs they assist. We have seen that membership in RPOs is less likely for households that have less land, status, connections, and liquid wealth, are headed by women, are located at the village periphery, and have an ethnicity different from the rest of the village. Channeling development assistance through RPOs may thus fail to reach the poorest of the poor, unless targeting is put in place.

The remainder of the paper is organized as follows. We begin in Section 2 by providing a context for our study by giving a brief description of rural producer organizations in the two studied countries. The testing strategy is discussed in detail in Section 3. We focus on the econometric issues involved in estimating the probability of two households matching by joining the same RPO. We show that the standard errors obtained by applying standard estimators to paired data are potentially grossly underestimated, and we derive a simple standard error correction that accounts for non-independence. The data are presented in Section 4, together with a description of the general characteristics of the studied households. In Section 5 we consider the determinants of RPO membership at the household level. Dyadic regression results are discussed in detail in Section 6. Section 7 concludes.

2 The context

Rural producer organizations (RPOs) are a neglected topic in development economics. In light of the facts on the ground, this lack of interest is surprising because RPOs are very common. In Senegal, for example, 68% of the households that we surveyed in 2002 had a head or a spouse who belonged to at least one RPO, referred to as *groupement*, in French, by the peasants themselves.[5] In Burkina Faso, where we carried out a similar survey, the corresponding figure is even higher. RPOs are therefore far from being a minor phenomenon. On the contrary, they are often a focal point of village life.

RPOs have been in existence for a long time and there is some evidence that they are becoming increasingly common. In Senegal, there is a long tradition of RPO activity going back to the pre-independence period (see Ba, Ndiaye, and Sonko (2002) or Faye and Ndiaye (1998) for good summaries). Numerous national confederations of RPOs operate under the umbrella of the *Conseil National de Concertation et Coopération des Ruraux* (CNCR). They carry considerable political clout that various governments have sometimes chosen to neglect, usually at their own expense. Their pervasive presence at the grass-roots level, the broad range of the activities that they touch upon, their historical depth and their political importance on the national stage imply that RPOs are perhaps, apart from the extended family, the most important social structure in rural Senegal.

In contrast to Senegal, the Burkinabe peasant movement is a relatively recent development, spurred on in part by the terrible drought of 1973, and especially by the progressive withdrawal of the state from rural areas in the early 2000s. Regional and national federations are less powerful than their Senegalese counterparts, with the possible exceptions of the *Naam* movement and the efficient *filières* (marketing networks) associated with relatively successful export crops such as cotton and string beans. Though the state has recently created regional Chambres d'Agriculture, these structures have not been appropriated by the peasants themselves, as they have been in Senegal.

[5] The operational definition of an RPO adopted here corresponds very closely to the term *groupement* used by the villagers. Essentially, an RPO is an organization created by producers in order to render services to the members of the group (although many RPOs also carry out activities, such as village cleanups, that benefit everyone). The group being an *association of members* is the key feature here, and it implies that traditional African mutual aid societies such as *tontines* (ROSCAs) are not RPOs, according to our definition. Tontines would be better classified under a *service NGO* heading. On the other hand, a *groupement* may set up a *tontine* as part of its operations.

Arcand (2004) and DeJanvry and Sadoulet (2004) have classified RPO activities into five broad classes: (i) furnishing assistance to income-generating activities (the main ones being petty commerce, irrigated agriculture and the production of garden vegetables), (ii) managing common property resources (forests, grazing land, water, fish stocks), (iii) providing social cohesion, redistribution or insurance (examples include cereal banks, collective fields, *tontines*), (iv) helping with training and information dissemination, and (v) engaging in external representation (within local development committees or higher level confederations of RPOs). RPOs are involved in most of the rare agricultural export success stories that Senegal and Burkina Faso have to offer, such as cherry tomatoes and string beans.

There are at least two compelling reasons for studying the matching process that leads to RPO formation. First, there is a widespread belief among many development practitioners that RPOs match the poor with the poor while the matching of the rich with the rich is believed to take place outside of the RPO sphere. If true, this would over time generate a potentially explosive polarization of rural societies into two distinct socioeconomic classes. According to this view, RPOs may provide services to their members, but these members are often thought to have no viable alternative. RPOs are thus seen as safety nets constructed by the poor for themselves, but which do not have access to the assets of the richer elements of the population. Moreover, when relatively rich or socially prestigious individuals participate in RPO activities, their actions are largely interpreted as being driven by predatory designs. Assessing whether this is indeed the case is therefore of some interest in terms of the distributional impact of fostering RPOs.

Second, it is of general interest in the West African context to study whether traditional norms such as ethnicity and caste remain important in terms of social interaction, or whether they have been (or are being) replaced by more narrowly focused economic concerns. In some sense, identifying those factors that lead to households matching under the *aegis* of RPOs is a manner of weighting the extent to which *homo economicus* has supplanted *homo traditionalis*.

3 Testing strategy

We wish to identify the factors associated with RPO membership. In particular, we are interested in testing whether members in a given RPO differ systematically from non-members in terms of wealth, status, ethnicity, and geographical proximity. We also want to investigate assortative matching. We have data on household membership in RPOs and information on a vector of variables x – e.g., ethnicity, wealth, status – that can potentially explain why two randomly selected households i and j are in the same RPO. Households that are 'closer' in some relevant metric are expected to be more likely to join the same RPO. Our problem is to identify which of these dimensions matters, given that proximity measures are typically correlated with each other.

3.1 Membership regression

We begin by estimating a regression of the form:

$$\Pr(m_{iv} = 1) = \lambda(\alpha x_{iv} + u_{iv}) \tag{1}$$

where $m_{iv} = 1$ if household i in village v belongs to an RPO, and $m_{iv} = 0$ otherwise, and $\lambda(.)$ is the logit function. The vector of regressors x_{iv} includes various characteristics of household i potentially associated with membership in producer organizations.

Estimation of regression (1) can tell us whether household characteristics x_{iv} differ systematically between RPO members and non-members. For instance, it can tell us whether RPO members are systematically wealthier than non-members, or whether members of a specific ethnic group are more likely to belong to RPOs. To the extent that household characteristics are correlated with each other, a multivariate regression such as (1) allows us to distinguish the factors that drive RPO membership from those that are correlated with membership only because they are correlated with driving factors. For instance, it can tell us whether the observed relationship between ethnicity and RPO membership disappears once we control for wealth, economic status, or social embeddedness.

For regression (1) to be meaningful, we must adequately control for household size. The reason is that each (adult) household member can, in principle, joint an RPO. The likelihood

that at least one member of a household belong to an RPO therefore increases with household size. The question then arises of what functional form to select.

To work this out, let p be the probability that an individual belongs to an RPO. If membership is independent across individuals in the same household the probability that at least one household member belongs to an RPO is $1-(1-p)^N$, where N is the size of the household. In contrast, if membership is perfectly correlated across household members, Pr(at least one member) $= p$. Generalizing from the above, the probability can be approximated as

$$\Pr(\text{at least one member}) \approx 1-(1-p)^{N^\delta} \tag{2}$$

where $\delta \leq 1$ measures the extent to which outcomes are correlated within households. If we let $p = \frac{e^{x\beta}}{1+e^{x\beta}}$, can we find a way of writing a logit regression model that approximates (2)? Numerical experimentation reveals that, for values of N in the relevant range, a rough approximation can be found as:

$$1-\left(1-\frac{e^{x\beta}}{1+e^{x\beta}}\right)^{N^\delta} \approx \frac{e^{x\beta+\delta\log(N)}}{1+e^{x\beta+\delta\log(N)}}$$

This means that adding $\log(N)$ in regression (1) is an effective of controlling for household size.

We also need a way of controlling for village size and for the number of RPOs in the village. Suppose there are M RPOs in the village, all equivalent. If all villagers are free to join any group, the number of groups M and the number of individuals in the village V should not matter. Now suppose that, for whatever reason, there is a constraint on group size. Joining a group is thus more difficult when M/V is small.

To illustrate this possibility, suppose that, among those who wish to join an RPO, only a proportion $\sigma M/V$ gets to join; the others are rationed out. We have $\Pr(member) = p\sigma\frac{M}{V}$. Letting $\Pr(member) = \frac{e^a}{1+e^a}$, we get:

$$\begin{aligned} a &= \log\frac{p\sigma\frac{M}{V}}{1-p\sigma\frac{M}{V}} \\ &\approx \log p + \log\sigma + \log(M/V) + p\sigma M/V + O^2 \end{aligned}$$

Given that M/V is typicaly a very small number, variation in a is driven primarily by

$\log(M/V)$. Hence adding a term in $\log(M/V)$ in (1) controls for limits on group size. If this term has a positive coefficient, group size is constraining.

If RPO membership is correlated within households, the average household size V/H matters as well, with H the number of households in the village. If correlation is perfect and group size is constraining, household membership only depends on $\log(M/H)$, not on $\log(M/V)$. If correlation is imperfect, both matter. Imperfect correlation in RPO membership within households can thus be captured by including $\log(M/V)$ and $\log(V/H)$ in (1). If membership is independent within households, the coefficient of $\log(V/H) = 0$. In contrast, if membership is perfectly correlated within households, membership depends only on $\log(M/H)$, which implies that the coefficient of $\log(M/V)$ and $\log(V/H)$ should be equal.[6] This can easily be tested.

Finally, we wish to allow for the possibility that RPOs are dedicated to a specific interest group or activity. The probability that an individual finds a group catering to his or her special interest therefore increases with the absolute number of groups in the village. To capture this possibility, we include $\log M$ as a separate regressor. If the coefficient of $\log M$ is positive, this suggests that group diversity matters.

3.2 Dyadic regression

Although regression (1) is useful, it falls short of our objective on two counts. First it cannot tell us whether geographical proximity matters: the distance between households is a relative concept, not an individual characteristic, and hence its effect cannot be studied using model (1).[7] Secondly, it can only identify certain types of assortative matching. To see why, consider a relevant household characteristic, such as wealth. Regression (1) enables us to test whether

[6] We need to show that:

$$\eta \log(M/H) = \eta \log(M/V) + \eta \log(V/H)$$

We have:

$$\begin{aligned} \eta \log(M/V) + \eta \log(V/H) &= \eta \log M - \eta \log V + \eta \log(V) - \eta \log(H) \\ &= \eta \log M - \eta \log H \\ &= \eta \log(M/H) \end{aligned}$$

[7] Using (1) it would be possible to study whether households located, say, to the South of the village are systematically more likely to belong to an RPO. But this is different from ascertaining whether members of the same RPO tend to originate from the same part of the village, irrespective of whether this part is in the South or the North of the village.

RPO members are systematically wealthier than non-members. But it cannot test whether, in some villages, RPOs are made up of wealthy households while in others they are made up of poor households – or of average households.

This is illustrated in Figures 1 and 2. In Figure 1, RPO members and non-members differ systematically in the absolute level of the relevant household characteristic – say wealth. In Figure 2, RPO members are more alike in terms of wealth than non-members, with both rich and poor outside the organization. We could imagine yet another situation – the reverse of Figure 1 – where the poor are in the RPO and the rich are not. We want to test whether RPOs tend to contain households that are more similar than non-members in some important dimensions. In case there are multiple organizations in a given village, we also want to test whether the rich and poor join different RPOs, something that regression (1) cannot do.

To solve this inference problem, we apply dyadic regression methods developed for network analysis. Association membership can be represented as a graph in which each household is a node and a link between two nodes i and j exists if i and j belong to the same RPO. The set of all links in village v can be summarized as an $N \times N$ matrix $M_v = [m_{ijv}]$ where N is the number of households in village v, and $m_{ijv} = 1$ when households i and j belong to the same RPO, and $m_{ijv} = 0$ otherwise.[8]

We estimate a dyadic regression of the form

$$\Pr(m_{ijv} = 1) = \lambda(\beta x_{ijv} + u_{ijv}) \tag{3}$$

where $\lambda(.)$ is the logit function. As discussed in Fafchamps and Gubert (2006), the estimation of regressions of this form raises two types of difficulties: identification and inference. The first problem relates to the form in which regressors x_{ijv} enter the regression. The second relates to the estimation of standard errors. We discuss these in turn.

Regressors include two types of variables: attributes w_{ij} of the link between i and j, such as the geographical distance between i and j; and attributes z_i and z_j of households i and j. Regressors must enter a dyadic regression in a symmetric fashion so that the effect of (z_i, z_j) on m_{ij} is the same as the effect of (z_j, z_i) on m_{ji}. Dyadic regressors must therefore be written

[8] In practice, we drop the N ii pairs on the diagonal since, by definition, a household is in the same RPO as itself.

in a way that preserves this symmetry.

In our case, the dyadic relationship is non-directional since, by construction, $m_{jiv} = m_{ijv}$ for all i, j. Symmetry therefore requires that regressors satisfy $\beta x_{ijv} = \beta x_{jiv}$. One easy way of satisfying this requirement is to specify:

$$\beta x_{ijv} \equiv \beta_0 + \beta_1 |z_{iv} - z_{jv}| + \beta_2 (z_{iv} + z_{jv}) + \beta_3 |w_{ijv}| + u_{ijv} \tag{4}$$

where z_i and z_j are characteristics of individual i and j thought to influence the likelihood of a link m_{ijv} between them.

The interpretation of equation (4) is straightforward: β_1 measures the effect of differences in attributes on m_{ijv} while β_2 captures the effect of the combined level of z_{iv} and z_{jv} on m_{ijv}. For instance, suppose that z represents wealth. A positive β_2 implies that RPO members are systematically wealthier than non-members; its interpretation is thus similar to the wealth coefficient in equation (1). In contrast, a negative β_1 means that households that differ a lot in their wealth level are unlikely to belong to the same organization. In other words, a positive β_2 means that RPOs are made primarily of wealthy households, while a negative β_1 means that members of the same RPO tend to have similar wealth levels, i.e., the rich team up with the rich and the poor with the poor. The same formalism can be applied to the case where z_{iv} is a dummy variable.[9]

Through w_{ijv}, equation (4) allows the identification of pure relative effects, such as the geographical distance between households i and j. It also allows for purely relative measures of social distance. For instance, we can include in w_{ijv} a dummy variable that equals 1 if i and j belong to the same ethnic group, and 0 otherwise. This enables us to test whether households sort by ethnicity when they join RPOs.

Observations in equation (4) are not independent. This is due to the presence of individual-specific factors common to all observations involving that individual. It follows that $E[u_{ij}, u_{ik}] \neq 0$ for all k and $E[u_{ij}, u_{kj}] \neq 0$ for all k. By the same reasoning, we also have $E[u_{ij}, u_{jk}] \neq 0$ and $E[u_{ij}, u_{ki}] \neq 0$.[10] Provided that regressors are exogenous, applying OLS to a dyadic

[9] For dichotomous regressors, there are typically several equivalent ways of incorporating them in the regression. The formalism of equation (4) offers the advantage of consistency of notation and allows for easy interpretation.

[10] This situation bears some formal resemblance to random effects models with two-way error components discussed for instance by Baltagi (1995), except that here we have four-way random effects.

regression yields consistent coefficient estimates but standard errors are inconsistent, leading to incorrect inference.

Robust standard errors must correct for cross-observation correlation in the error terms involving similar individuals. To obtain such robust standard errors, we extend the method that Conley (1999) developed to deal with spatial correlation of errors. Conley's method is itself an extension of the robust covariance matrix popularized by White and applied to time series by Newey and West. In the case of OLS, the formula for the network-corrected covariance matrix is of the form (Fafchamps and Gubert 2006):[11]

$$AVar(\widehat{\beta}) = \frac{1}{N-K}(X'X)^{-1}\left(\sum_{i=1}^{N}\sum_{j=1}^{N}\sum_{k=1}^{N}\sum_{l=1}^{N}\frac{m_{ijkl}}{2N}X_{ij}u_{ij}u'_{kl}X_{kl}\right)(X'X)^{-1} \qquad (5)$$

where β denotes the vector of coefficients, N is the number of dyadic observations, K is the number of regressors, X is the matrix of all regressors, X_{ij} is the vector of regressors for dyadic observation ij, and $m_{ijkl} = 1$ if $i = k, j = l, i = l$ or $j = k$, and 0 otherwise.[12] The only structure imposed on the covariance structure is that $E[u_{ij}, u_{km}] = 0$.[13] Formula (5) also corrects for possible heteroskedasticity. Estimation results reported in Section 6 show that, in our data, uncorrected standard-errors are dramatically underestimated, often by at least one order of magnitude.

Other forms of non-independence may also be present in the data. One particular source of concern is the possibility of correlated errors within villages. To correct for this possibility, we also report robust standard errors that allow for village clustering of errors. It is easy to see that correcting for village clustering also corrects for dyadic non-independence, since the

[11] Other methods have been devised to conduct inference on network data. One such method relies on permutation methods popularized by Good (2000). This method was first applied to network analysis by Hubert and Schultz (1976) and subsequently refined by Krackhardt (1987) and Nyblom, Borgatti, Roslakka and Salo (2003). Instead of correcting standard errors, permutation methods correct p-values directly. This procedure is known as Quadratic Assignment Procedure or QAP in the literature (Hubert and Schultz 1976). This approach has gained much popularity among sociologists who typically compute QAP p-values using a linear probability model. We believe our method to be statistically more efficient since it does not rely on bootstrapping. The first version of this paper used QAP to derive p-values. Inference was similar to using dyadic standard errors. A GLS estimator for dyadic data – called P2 – has also been developed by sociologists (Dekker, Krackhardt and Snijders 2003). This method is sensitive to heteroskedasticity, which is why we prefer to keep OLS and logit estimates and correct standard errors directly (Wooldridge 2002).

[12] By construction, all observations where $j = i$ or $k = l$ are identically zero and hence are omitted. Division of the inner term by 2 corrects for the double counting implied by the simple way we have written the formula.

[13] Computation of (5) as written is very computer-intensive. It is however possible to take advantage of specific Stata commands and of the structure of the m_{ijkl}'s to reduce computation to a small number of matrix manipulations. To apply formula (5) to logit, $(X'X)^{-1}$ needs to be replaced by an expression that depends on the scores.

village clustering correction includes the inner sum in (5).

4 The data

The data stem from a large scale survey of 250 villages in Senegal and 268 villages in Burkina Faso. The surveys were undertaken in 2002 under the auspices of the World Bank. In Senegal, the survey was organized in tight collaboration with an organ of the principal national peasant organization, the *Association Sénégalaise pour la Promotion des Petits Projets de Développement à la Base* (ASPRODEB). In Burkina Faso, where no such strong national federation exists, the survey was organized in the context of the *Projet National de Développement des Services Agricoles* (PNDSA II), funded by the World Bank.

For the purpose of the surveys, a rural producer organization or RPO is defined as an organization created by producers to provide services to its members.[14] In practice, this definition corresponds very closely to the term *groupement* used by villagers.[15]

In each village, an informant was hired who, under the supervision of village inhabitants, carried out a census of *all* households, for whom he collected information on socio-demographic variables and on their participation in village RPOs.[16] Separate questionnaires cover village infrastructure and RPO activities. Details on the surveys, carried out almost contemporaneously in Senegal and Burkina Faso, can be found in Arcand (2004) and DeJanvry and Sadoulet (2004).

The Senegal survey covers three geographical areas (the Senegal river basin, the so-called "peanut basin", and the area known as the *Niayes*), selected to get as broad a coverage as possible of RPO activities. The survey design involves stratified sampling, with 19 sub-regional clusters (corresponding to a Senegalese administrative district known as a *communauté rurale*), and 250 villages.

The Bukina Faso survey covers three broad regions: (i) the cotton region (mainly Co-

[14] Many RPOs carry out activities, such as village cleanups, that benefit everyone. But that is not their primary purpose.

[15] This definition implies that traditional African mutual aid societies such as *tontines* (ROSCAs) are not regarded as RPOs, even though a *groupement* may set up a *tontine* as part of its activities.

[16] The definition of a household used here and in most surveys in Senegal is the following: a household is a group of individuals whose meals are organized by one person (the household head). A "household" is therefore a "cooking unit". In most cases, the members of a household that is defined in this manner live within the same *concession* or *carré*. All of the questionnaires used in the surveys, as well as a number of the reports cited earlier, are available at http://www.cerdi.org/P_Perso/PP_Home.asp?IDUSER=arcand

moë, Tapoa and Nahouri) where living standards are usually higher than in the rest of the country and RPOs are often due to intervention by Sofitex (the national cotton marketing corporation); (ii) the central Mossi plateau, which is quite arid and where traditional norms are likely to be predominant; and (iii) the Oudalan region, which is ecologically a near-desert, where livestock constitutes the main activity, and where the Peuhls, Tamacheks and Bella ethnic groups are predominant. As in Senegal, the Burkina Faso survey involved stratified sampling, with 22 clusters at the *département* level, with approximately 14 randomly-drawn villages per cluster, yielding a total of 289 villages. A little over 20,000 households were interviewed in the two countries – 12,212 in Burkina Faso and 8,415 in Senegal.

Table 1 summarizes the main characteristics of the Senegal and Burkina Faso household surveys. The average rural household in our sample comprises 7.5 members in Burkina and close to 10 in Senegal. A small proportion of them are headed by women. The education level of surveyed household heads is very low, and many of them are illiterate. Surveyed households own on average around 3 hectares (7.5 acres) of land and a number of farm animals – mostly goats and sheep.

Asked to rank their economic status on a scale from 1 (very poor) to 4 (rich), respondents in both countries gave themselves an average ranking of 2=poor. Respondents were also asked whether they have family ties to various village authorities, such as the village chief, a religious leader, a *marabout*, or some other traditional authority figure. On the basis of their answers we constructed a social embeddedness index that takes values from 0 (no family ties to any village authority) to 4 (family ties to four different categories of village authorities). The average value of the index is 1, meaning that most respondents have family ties with some of the village authorities.

Membership in RPOs is detailed next. Information on membership is reported at the individual level. The first line reports the proportion of surveyed households in which at least one member belongs to an RPO. This represents over half of the surveyed households in Burkina Faso and nearly three quarters of them in Senegal. Next we report the proportion of surveyed households in which at least one male member belongs to an RPO. We see that two-fifths to one half of surveyed households fall into this category. We also report the percentage of households in which at least one female member belongs to an RPO. The figures differ

between Burkina – where less than a third of surveyed households fall into this category – and Senegal – where two thirds of households are in this category.

The ethnic make-up of the surveyed villages is described next. In both countries we observe a lot of diversity, with no ethnic group accounting for more than one third of the sample. Within villages, however, ethnic diversity is less pronounced. In this region of West Africa, the Peuhl – or Fulani – and the Touareg – or Tamacheks – traditionally emphasize livestock raising. The Peuhl are found in both survey countries.

Table 2 reports some relevant characteristics of the surveyed villages. We see that the number of households in each village turns around 100 to 200, with quite a bit of variation across villages. The average number of inhabitants is around 1000. Using data on ethnic composition from the village questionnaire, we computed the ethnic fractionalization index for each village.[17] The index takes values from 0 (perfect homogeneity) to 1 (extreme fragmentation). Results show that villages in Senegal are on average more ethnically homogeneous than in Burkina. Both countries nevertheless exhibit quite a bit of ethnic heterogeneity at the village level.

The two surveyed areas are characterized by an abundance of RPOs. In Burkina Faso, each surveyed village has an average of 3.2 RPOs. In Senegal the average is slightly lower, at 2.4. Perhaps because of their poverty, surveyed villages are frequently the target of governmental, bilateral donor or NGO activity, with almost 60% of surveyed villages having some form of external partnership.

We also report village characteristics that may be important determinants of the returns to joining a producer organization. Wells can be used for horticulture, and we see that villages differ in terms of the number of wells they have. Electricity can be used to power irrigation pumps. The data show that very few Burkinabe villages have electric power, but up to one fifth of surveyed Senegalese villages do. The sale of agricultural surplus is facilitated if producers have easy access to a market outlet. The data show that only a quarter of all surveyed villages have a village market. Production for the market is hindered in villages that, during the rainy season, are isolated from the rest of the country by impassable roads. The data show that surveyed villages vary along this dimension as well.

Table 3 breaks down households between RPO members and non-members and reports

[17] This is basically a Herfindhal index.

t-tests for all variables. Villages with no RPO are dropped so as to only compare households with access to RPO membership. We have taken the log of variables with a skewed distribution (i.e., household size and wealth) so as to avoid test results driven by outliers. Results show that, on average, RPO members unambiguously come from larger, wealthier households. They have closer family ties with village authorities and are less likely to be headed by a woman. This is true in both countries and the difference is highly significant, albeit not always large in magnitude.

We also note some differences in RPO membership across ethnic groups. In Senegal, over 95% of the Toucouleur belong to RPOs compared to 85% for the average household.[18] We also find that the Peuhl and Serere are less likely to belong to an RPO. Similar difference are found in Burkina Faso, where the Peuhl, Bissa and Gourmatche are less likely to belong in RPOs. Because of the emphasis many Peuhl put on livestock raising, they tend to live outside the village so as to facilitate access to pasture and minimize crop destruction. Their culture is also much more individualistic and less centered on the overall community than is that other ethnic groups. These factors may explain why they are under-represented among RPO members.

Turning to differences in village characteristics, we see that the average RPO member tends to come from villages with fewer households and inhabitants. But while Burkinabe RPO members tend to live in villages with more RPOs, the opposite holds in Senegal. As we have argued in Section 2, more relevant comparisons are in terms of $\log(M/H)$ and $\log(V/H)$. The Table shows that, as expected, RPO members tend to live in villages where average household size V/H is larger and where the density M/H of RPOs per inhabitant is higher.

The relationship between other village characteristics and RPO membership varies between the two countries with no identifiable pattern. For instance, in Burkina Faso, RPO members tend to live in villages that are less ethnically homogeneous and more easily accessible in the rainy season; but the opposite holds in Senegal. To clarify the respective roles of these various factors we need a multivariate analysis, to which we now turn.

[18] Living in a village with at least one RPO.

5 The determinants of RPO membership

We begin by estimating membership regression (1). We wish to investigate whether RPO membership represents all sectors of rural society or whether wealthier and better connected households are more likely to belong to an RPO. Our main objective is thus to test whether various components of wealth and social status are associated with RPO membership. As explained in Section 2, we control for household size $\log N$, number of RPOs/villager $\log(M/H)$, average household size $\log(V/H)$, and group diversity $\log M$.

Results are presented in Tables 4A and 4B. Three sets of regression results are presented. In the first column, the dependent variable takes the value 1 if any member of the household belongs to an RPO. In the second column, the dependent variable is 1 if any male member of the household belongs to an RPO. The third column is the same as column two, but for female membership. The estimator is logit. Robust standard errors corrected for village clustering are reported in all cases.

We begin by noting that, in five of the six regressions, household size is significant with the anticipated sign: larger households are more likely to belong to an RPO. This indicates that membership is not perfectly correlated among household members. We also find that in all regressions the likelihood of membership increases in $\log(M/H)$ – significantly so in four out of six regressions. This suggests that there are constraints to group size: larger villages need more groups to maintain the same (conditional) probability of membership. Average household size is also significant and positive in three regressions, suggesting that membership is correlated across household members. In none of the six regressions can we reject the hypothesis that the coefficients of $\log(M/H)$ and $\log(V/H)$ are equal, suggesting perfect correlation in membership within households. Individual coefficients are not estimated very precisely, however, so that the evidence of perfect correlation is not strong – we could probably equally fail to reject that it is 0.8 or any other large number less than 1. Since the coefficient associated with household size $\log N$ is itself significant, the lesson we draw is that there is a strong but imperfect correlation in membership across household members.

Turning to household characteristics, we find a significant positive association between wealth or status and RPO membership, albeit with some variation across regressions and countries. Land ownership is significant in four out of six regressions and self-assessed eco-

nomic status in two (both in Burkina). Family ties with village authorities are highly significant in the three Burkina regression but in none of the Senegal regressions. This suggests that social embeddedness is a more important determinant of RPO membership in Burkina Faso than in Senegal.

We also find that young household heads are more likely to belong to an RPO. In Burkina, female headed households are less likely to belong, but in Senegal the effect is ambiguous. Once we control for land and status, livestock ownership does not appear to retain any significant systematic association with RPO membership. In contrast, controlling for wealth differences does not eliminate the role of ethnicity, suggesting that differences in ethnicity play a role in RPO membership that is distinct from that of wealth and status. In both countries the Peuhl are less likely to belong to an RPO, a finding that confirms our earlier observation.

In Senegal, all village characteristics except one are insignificant. In Burkina Faso we find that RPO membership is associated with more wells, less electricity, and more ethnic fractionalization. The fact that these results are not robust suggests that village heterogeneity is perhaps not adequately controlled for by village characteristics.

To correct for this, we reestimate equation (1) with village fixed-effects. We also continue to correct standard errors for heteroskedasticity and village clustering. Results are presented in Tables 5A and 5B. Results are in general stronger, confirming that village heterogeneity is at issue. We now find that land ownership is significant in all regressions and that family ties with village authorities are significant in five out of six regressions. The magnitude of the coefficient remains stronger in Burkina Faso, however. The ownership of goats and sheep – which constitute the most liquid form of wealth in the study areas – is now positively associated with RPO membership in all six regressions.

Results also confirm that the relationship between ethnicity and RPO membership cannot be fully explained either by wealth effects – which are captured explicitly in the regression – or by differences in ethnic composition across villages – which are captured by village fixed effects. There is a systematic association between ethnicity and RPO membership within villages. Whether this is due to discrimination or self-selection is unclear. In Burkina Faso, the two groups that are negatively affected – the Peuhl and the Touareg – are traditionally

specialized in livestock raising. In that case, differences in professional focus may explain differences in RPO membership across ethnic groups.

6 The determinants of RPO matching

The empirical analysis we have conducted so far tells us that RPO members differ systematically from non-members. But it does not tell us whether members of the same RPO are more alike than non-members. To do this, we now turn to the dyadic methods described earlier.

Table 6 presents descriptive statistics for the dyadic variables used in the analysis. The dependent variable m_{ijv} is equal to 1 if households i and j in village v belong to the same RPO, and 0 otherwise. As before we consider three dependent variables. In the first one, $m_{ijv} = 1$ if any member of households i and j belongs to the same RPO. In the second (third), $m_{ijv} = 1$ if both households have a male (female) member in the same RPO. Summary statistics reported in the Table show that the proportion of household pairs that belong to the same RPO is higher in Senegal than in Burkina Faso. This is particularly true for female membership. In both countries, a non-negligible proportion of household pairs have more than one RPO in common.

Next we present the regressors used in the analysis. Two distance measures w_{ijv} are used – physical distance and a dummy that takes the value one if both household heads belong to the same ethnic group.[19] We see that there is variation in physical distance. In contrast, most pairs of households share the same ethnicity. This is because villages are more ethnically homogeneous than the surveyed population as a whole.

Household regressors are divided into two groups: absolute differences and sums. These correspond to $|z_{iv} - z_{jv}|$ and $(z_{iv} + z_{jv})$ in equation (4). Village regressors, which by definition are identical for two households in the same village, only appear in levels, not in differences. The reported number of pairs is quite large – close to 700,000 observations in Burkina Faso, half that in Senegal.[20]

[19] Physical distance is computed as follows. For each village, a stylized map was constructed that locates each household in the village on a grid. On this grid are placed the *concessions* or *carrés* – blocks of households typically surrounded by a fence – that make up the village. Physical distance between two households is computed as the euclidian distance between their grid coordinates.

[20] The number of observations reported here includes both the upper and lower triangles of each matrix

Tables 7A and 7B present coefficient estimates of dyadic regression (3). Regressors that control for the sum of household characteristics play basically the same role as household characteristics in the previous section. Suppose, for instance, that wealth makes households more likely to belong to an RPO. In that case, a pair of households that are both wealthy are more likely to belong to an RPO, and thus the coefficient associated with the sum of household wealth will be positive. Since we control for level effects, a negative coefficient for a difference variable indicates assortative matching: the more different two households are, the less likely they belong to the same RPO.

The regressions presented in Tables 7A and 7B enable us to test assortative matching versus level effects, associated for example with elitist recruitment. As an illustration, if only the coefficient associated with the wealth difference variable is significant, households tend to belong to RPOs with households of a similar wealth level – i.e., the rich with the rich and the poor with the poor – but the wealth level *per se* does not matter, i.e., households of any wealth level are equally likely to belong to the same RPO. In contrast, if only the coefficient associated with the wealth sum variable is significant, then the wealthy are more likely to be members. What initially appears to be assortative matching (the rich are with the rich) is in fact due to level effects, not to matching.

In the Tables we report two sets of standard errors. The first set is computed using the dyadic correction formula given in (5). The second set controls for village clustering and thus allows for any error correlation within villages. In general it leads to more conservative – and possibly inefficient – inference, which is why we report both sets of standard errors.

Turning to the results themselves, we begin by noting that geographical and ethnic proximity are very significant determinants of RPO matching in Burkina Faso, but not in Senegal. This is consistent with earlier findings that Burkinabe villages have more RPOs but a smaller proportion of households in them, suggesting higher RPO fragmentation in Burkina than in Senegal. What Table 7A adds to this picture is the observation that fragmentation in Burkinabe RPOs follows geographical and ethnic lines.

The results indicate assortative matching along many dimensions. Indeed, most difference

M_v. The reason is that the computation of dyadic standard errors is achieved using a method that allows for directional networks, and hence requires both triangles. Since our network matrices are not directional, this means that each observation appears twice in the dataset. This does not affect results, however, because the standard error formula we use corrects for this.

variables have a negative coefficient. We have already seen that larger households are more likely to belong to an RPO. This is confirmed here as well – see the coefficient of the sum of household size. Tables 7A and 7B further show that households also tend to match on household size. This means that, on average, RPO member households tend to be larger than non-member households. But there are also some RPOs with smaller households grouped together.

Turning to other households characteristics, across the two countries and the three regressions we find significant negative coefficients for several livestock variables, suggesting matching on liquid wealth. This is true even though the level of livestock wealth is either generally not significant (Burkina Faso) or significant but with conflicting signs (Senegal). As in the results presented in section 5, we find that Burkinabe RPO members tend to have more family ties with village authorities: the coefficients associated with the sum variable are significant in all three regressions. In addition, we also find evidence of assortative matching on family ties, suggesting that there exist some RPOs in which most members have weak family ties with village authorities.

For age and land ownership, we obtain different results in the two countries. In Senegal, there is evidence of assortative matching on land ownership, but of dissimilar matching on age. The opposite results obtain in Burkina. To interpret these results correctly, we need to consider the coefficients associated with the sum variables. Regarding land, we find as in Section 4 that RPO members in both countries have on average more land than non-members.[21] In Senegal we also find assortative matching, suggesting that some RPOs are composed predominantly of land-poor households. In Burkina, in contrast, we find dissimilar matching, implying that some households with very little land belong to the same RPO as land-rich households. This may be the consequence of matching on family ties, which is much stronger in Burkina. The coefficients associated with village characteristics appear at the bottom of the two Tables. Findings are by and large similar to those reported in the preceding section and need not be discussed further.

Tables 7A and 7B control for a number of village characteristics and report standard errors that are corrected for village clustering. But they may be affected by unobserved village characteristics that are correlated with regressors. To check whether our results are

[21] Albeit the result in not significant for males in Burkina.

robust to unobserved village heterogeneity, we reestimate all dyadic regressions controlling for village fixed effects. To improve efficiency, we redefine the dependent variable as the number of common RPOs to which both households belong. Values vary between 0 and 3. The estimator is least squares with village fixed effects. We again report two sets of standard errors. The first set is corrected for dyadic dependence. The second allows for village correlation of residuals.

Results are presented in Tables 8A and 8B. Results are in general stronger and more consistent across regressions and countries, suggesting that village heterogeneity is indeed a problem. We now find evidence that physical and ethnic proximity matter in both countries, although the effect is stronger in Burkina. This indicates matching along geographical and ethnic lines in both countries. Assortative matching in livestock wealth is confirmed. So is assortative matching on land in Senegal and on family ties with village authorities in Burkina Faso. We now also find assortative matching in education in Senegal and in subjective economic status in Burkina. Finally, female-headed households are more likely to be found in RPOs with other female-headed households in both countries. These results confirm the presence not only of wealth and status effects in both countries, but also of assortative matching according to a variety of wealth and status indicators.

7 Conclusion

We have examined the determinants of membership in rural producer organizations in Burkina Faso and Senegal. We have found evidence that, on average, it is the more fortunate members of rural society who belong in RPOs. In Senegal, the dominant criterion is land ownership. In Burkina Faso it is family ties with village authorities and (subjectively assessed) economic status. Ethnicity also plays a role: RPO membership is less likely for ethnic groups that traditionally emphasize livestock raising.

We looked for evidence of assortative matching along multiple dimensions. To this effect we developed an original methodology based on dyadic regressions. We found robust evidence of assortative matching by physical and ethnic proximity as well as by wealth and social status.

Though our findings are clear, their interpretation is less so. This is because we do not

know whether similarity is a cause or a consequence of assortative matching. In other words, we do not know whether RPO members were richer and more alike than non-RPO members before they joined the RPO, or whether they became so as a result of direct and indirect RPO effects.

Given the local context, we suspect that ethnicity, age, land ownership (most of which is inherited), and family ties with village authorities are largely predetermined. Consequently, it is unlikely that assortative matching along these dimensions results from reverse causation. Things are less clear for livestock, which largely stems from individual accumulation. These important issues are left for future research.

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Table 1. Descriptive statistics	**Burkina Faso**		**Senegal**	
Household characteristics	Mean	St.dev.	Mean	St.dev.
number of household members	7.5	5.0	9.8	6.0
age of head	44	16	50	15
female head dummy	2.4%		7.1%	
education level of head (in years)	0.3	1.0	0.7	1.4
owned land (ha)	3.1	3.7	2.7	3.6
nber of horses and donkeys	0.6	1.2	2.1	4.1
nber of cattle	3.6	10.9	2.9	8.6
nber of goat and sheep	7.5	16.7	7.8	13.2
economic status (from 1=poor to 4=rich)	2.1	1.0	2.0	0.9
family ties with authorities (index from 0 to 4)	0.9	1.0	0.8	0.9
RPO membership				
% which are member of at least one RPO	56.3%		73.8%	
% with at least one male in RPO	47.2%		41.6%	
% with at least one female in RPO	30.2%		64.7%	
Ethnicity (Burkina Faso)				
Mossi	31.7%			
Gourmatche	18.1%			
Peuhl	12.3%			
Gourounsi	7.5%			
Touareg	5.6%			
Bissa	4.4%			
Other	20.4%			
Ethnicity (Senegal)				
Wolof			28.0%	
Peuhl			24.3%	
Toucouleur			23.5%	
Serere			19.0%	
Other			5.2%	
Number of observations	12212		8415	

Table 2. Village characteristics	**Burkina Faso**		**Senegal**	
	Mean	St.dev.	Mean	St.dev.
number of households	190	255	115	178
number of inhabitants	1309	1214	938	1070
ethnic fractionalization index	0.23	0.24	0.11	0.17
number of RPOs	3.2	3.7	2.4	2.3
% with at least one RPO	90.7%		78.4%	
number of wells	4.0	8.3	2.5	3.4
market in village	28.5%		26.8%	
electricity in village	2.2%		20.9%	
village accessible in rainy season	46.6%		64.3%	
Number of observations	268		250	

Table 3. Breakdown of household and village characteristics by members and non-members

	Burkina Faso				Senegal			
	mean for:				mean for:			
Household characteristics	non-mb.	members	all	t-stat	non-mb.	members	all	t-stat
log(number of household members)	1.69	1.91	1.83	**-18.21**	1.89	2.18	2.13	**-14.98**
female head dummy	0.03	0.02	0.02	**5.28**	0.12	0.07	0.08	**5.95**
age of head	44.12	44.97	44.65	**-2.67**	50.02	51.27	51.08	**-2.61**
education level of head	0.33	0.34	0.34	-0.15	0.78	0.72	0.73	1.23
family ties with authorities (index 0 to 4)	0.73	0.93	0.86	**-10.18**	0.64	0.82	0.80	**-6.08**
log(owned land +1)	1.04	1.26	1.18	**-16.63**	0.81	1.05	1.01	**-9.92**
log(nber of donkeys+1)	0.30	0.34	0.33	**-4.96**	0.70	0.66	0.66	**1.67**
log(nber of cows+1)	0.71	0.83	0.79	**-5.91**	0.44	0.47	0.46	-1.00
log(nber of goat and sheep+1)	1.39	1.58	1.50	**-8.27**	1.00	1.37	1.31	**-9.54**
economic status (from 1=poor to 4=rich)	1.93	2.18	2.09	**-13.29**	1.86	1.96	1.95	**-3.41**
Village characteristics								
number of wells	3.76	4.18	4.03	**-2.49**	2.80	2.65	2.67	1.24
ethnic fractionalization index	0.19	0.24	0.23	**-10.66**	0.15	0.10	0.11	**7.73**
market in village	0.31	0.29	0.29	**2.22**	0.32	0.30	0.31	1.43
electricity in village	0.02	0.02	0.02	-0.57	0.33	0.22	0.24	**7.79**
village accessible in rainy season	0.45	0.49	0.48	**-4.89**	0.76	0.63	0.65	**8.05**
number of households	199	169	181	**6.60**	146	124	127	**3.57**
number of inhabitants	1395	1296	1333	**4.08**	1173	1004	1029	**4.62**
number of RPOs	3.34	3.72	3.57	**-5.19**	2.92	2.71	2.75	**2.87**
log(# RPOs/# village inhabitants)	-6.06	-5.84	-5.92	**-13.73**	-5.88	-5.72	-5.75	**-6.28**
log(average household size)	2.09	2.19	2.15	**-9.23**	2.15	2.21	2.20	**-4.76**
log(number of RPOs in village)	0.89	1.00	0.96	**-7.37**	0.84	0.77	0.78	**3.08**
Number of observations	4132	6879	11011		1090	6209	7299	

Using only households in villages with at least one RPO

Table 4A. Determinants of RPO membership – Burkina Faso

	Any hh member		Male hh members		Female hh members	
Household characteristics	**Coef.**	**robust z stat.**	**Coef.**	**robust z stat.**	**Coef.**	**robust z stat.**
log(number of household members)	0.531	**6.65**	0.366	**4.65**	0.435	**5.37**
female head dummy	-0.153	-0.67	-0.531	**-1.93**	-0.597	**-2.26**
age of head	-0.009	**-4.16**	-0.014	**-6.50**	-0.000	-0.06
education level of head	-0.010	-0.34	0.000	0.00	-0.048	-1.45
family ties with authorities (index 0 to 4)	0.305	**4.68**	0.266	**4.01**	0.298	**3.95**
log(owned land +1)	0.346	**4.36**	0.274	**3.30**	0.064	0.68
log(nber of donkeys+1)	0.029	0.30	0.095	1.01	-0.120	-1.19
log(nber of cows+1)	-0.056	-1.12	-0.003	-0.06	0.038	0.70
log(nber of goat and sheep+1)	0.036	0.92	0.006	0.14	0.063	1.42
economic status (from 1=poor to 4=rich)	0.143	**2.53**	0.142	**2.59**	0.022	0.39
Ethnicity (Mossi is omitted category)						
peuhl	-0.781	**-3.09**	-0.540	**-2.10**	-0.554	**-1.71**
gourounsi	-0.080	-0.30	-0.790	**-2.48**	0.392	1.54
bissa	-3.105	**-4.15**	-3.092	**-5.35**	-1.924	**-2.64**
gourmatche	-1.041	**-4.84**	-0.849	**-3.69**	-0.843	**-3.08**
touareg	0.191	0.66	0.463	1.62	-1.205	**-2.71**
other	-0.247	-1.05	-0.144	-0.66	-0.304	-1.34
Village characteristics						
number of wells	0.016	**1.83**	0.015	**1.79**	0.008	1.13
ethnic fractionalization index	1.355	**4.15**	1.190	**3.41**	0.395	0.89
market in village	-0.038	-0.20	-0.071	-0.37	-0.015	-0.06
electricity in village	-1.068	**-1.67**	-0.882	-1.23	-1.343	**-2.83**
village accessible in rainy season	0.095	0.63	0.122	0.74	0.198	1.06
log(# RPOs/# village inhabitants)	0.359	**3.61**	0.365	**3.69**	0.283	**2.09**
log(average household size)	0.516	**3.97**	0.463	**3.58**	0.192	1.28
log(number of RPOs in village)	-0.015	-0.10	0.081	0.51	-0.065	-0.41
Intercept	0.076	0.12	0.266	0.40	-0.489	-0.58
Number of observations	10772		10772		10772	
Number of villages	239		239		239	
Pseudo R-squared	0.112		0.098		0.078	
Test of membership correlation within households						
chi-square	1.380		0.480		0.250	
p-value	0.240		0.488		0.616	

all z stat. based on robust standard errors corrected for village clustering

Table 4B. Determinants of RPO membership – Senegal

	Any hh member		Male hh members		Female hh members	
Household characteristics	**Coef.**	**robust z stat.**	**Coef.**	**robust z stat.**	**Coef.**	**robust z stat.**
log(number of household members)	0.754	**5.42**	0.083	0.78	0.582	**5.10**
female head dummy	-0.142	-0.64	0.523	**2.06**	-0.998	**-6.03**
age of head	-0.001	-0.38	-0.008	**-2.51**	0.005	1.61
education level of head	0.000	0.00	-0.042	-1.43	0.017	0.58
family ties with authorities (index 0 to 4)	0.152	1.32	0.047	0.49	0.067	0.85
log(owned land +1)	0.436	**3.15**	0.194	1.34	0.384	**3.26**
log(nber of donkeys+1)	-0.183	-1.31	-0.004	-0.04	-0.111	-0.97
log(nber of cows+1)	-0.157	-1.63	0.052	0.68	-0.147	**-1.84**
log(nber of goat and sheep+1)	0.155	1.53	0.223	**3.18**	0.085	1.12
economic status (from 1=poor to 4=rich)	-0.001	-0.01	-0.128	-1.58	0.060	0.66
Ethnicity (Wolof is omitted category)						
serere	-1.054	**-2.73**	-1.631	**-4.43**	-0.995	**-3.35**
toucouleur	1.167	**2.38**	0.495	1.33	0.316	0.91
peuhl	-0.664	**-1.68**	-1.047	**-2.93**	-0.542	-1.62
other	-0.538	-1.31	-0.076	-0.17	-0.322	-1.07
Village characteristics						
number of wells	0.045	1.17	0.023	0.85	0.022	0.76
ethnic fractionalization index	-1.267	-1.54	-0.111	-0.14	-1.998	**-2.76**
market in village	-0.094	-0.23	-0.134	-0.45	-0.184	-0.64
electricity in village	0.027	0.06	0.523	1.43	-0.092	-0.27
village accessible in rainy season	-0.445	-1.15	-0.355	-1.04	-0.430	-1.45
log(# RPOs/# village inhabitants)	0.416	1.51	0.364	**1.88**	0.160	0.80
log(average household size)	0.336	1.14	0.303	0.99	0.487	**1.76**
log(number of RPOs in village)	-0.586	**-2.47**	0.600	**2.48**	-0.475	**-2.35**
Intercept	2.583	1.59	1.287	1.01	0.332	0.29
Number of observations	7162		7162		7162	
Number of villages	194		194		194	
Pseudo R-squared	0.154		0.172		0.134	
Test of membership correlation within households						
chi-square	0.060		0.030		1.510	
p-value	0.803		0.863		0.220	

all z stat. based on robust standard errors corrected for village clustering

Table 5A. RPO membership controlling for village fixed effects – Burkina Faso

	Any hh member		Male hh members		Female hh members	
Household characteristics	**Coef.**	**robust z stat.**	**Coef.**	**robust z stat.**	**Coef.**	**robust z stat.**
log(number of household members)	0.654	**12.38**	0.489	**9.35**	0.629	**11.22**
female head dummy	-0.508	**-2.97**	-0.783	**-4.34**	-1.060	**-5.12**
age of head	-0.011	**-6.59**	-0.017	**-9.51**	-0.003	**-1.90**
education level of head	-0.004	-0.17	0.000	0.01	-0.009	-0.34
family ties with authorities (index 0 to 4)	0.445	**11.97**	0.399	**10.91**	0.309	**8.10**
log(owned land +1)	0.247	**4.71**	0.255	**5.00**	0.116	**2.04**
log(nber of donkeys+1)	0.140	**2.12**	0.071	1.11	0.031	0.45
log(nber of cows+1)	-0.047	-1.28	-0.007	-0.20	-0.019	-0.51
log(nber of goat and sheep+1)	0.096	**3.31**	0.099	**3.45**	0.094	**3.00**
economic status (from 1=poor to 4=rich)	0.172	**4.79**	0.166	**4.81**	0.108	**2.97**
Ethnicity (Mossi is omitted category)						
peuhl	-1.133	**-6.41**	-0.998	**-5.83**	-0.703	**-3.54**
gourounsi	0.676	**1.83**	1.063	**2.72**	0.290	0.67
bissa	1.188	1.61	0.520	0.70	1.465	**2.03**
gourmatche	1.011	**3.46**	0.773	**2.65**	1.554	**5.04**
touareg	-1.129	**-3.40**	-1.008	**-3.06**	-1.478	**-3.18**
other	-0.028	-0.16	-0.054	-0.35	0.294	1.54
Number of observations	9909		10084		9295	
Number of villages	212		220		204	
Minimum obs per village	10		10		10	
Average obs per village	46.7		45.8		45.6	
Maximum obs. per village	264		264		264	

Table 5B. RPO membership controlling for village fixed effects – Senegal

	Any hh member		Male hh members		Female hh members	
Household characteristics	**Coef.**	**robust z stat.**	**Coef.**	**robust z stat.**	**Coef.**	**robust z stat.**
log(number of household members)	1.079	**11.30**	0.406	**4.92**	0.818	**10.55**
female head dummy	0.364	**2.17**	1.295	**8.22**	-1.197	**-9.02**
age of head	-0.002	-0.71	-0.007	**-2.55**	0.005	**1.87**
education level of head	0.025	0.85	0.048	**1.72**	-0.010	-0.40
family ties with authorities (index 0 to 4)	0.160	**2.48**	0.160	**2.95**	0.072	1.34
log(owned land +1)	0.500	**4.94**	0.441	**4.99**	0.319	**3.64**
log(nber of donkeys+1)	0.205	**1.85**	0.157	**1.73**	0.175	**1.95**
log(nber of cows+1)	-0.135	**-1.93**	-0.008	-0.15	-0.112	**-1.92**
log(nber of goat and sheep+1)	0.112	**2.05**	0.115	**2.49**	0.085	**1.93**
economic status (from 1=poor to 4=rich)	-0.001	-0.02	-0.003	-0.04	0.029	0.51
Ethnicity (Wolof is omitted category)						
serere	0.428	1.11	-0.692	**-2.01**	-0.024	-0.07
toucouleur	-0.857	**-2.00**	-0.638	**-2.02**	-0.959	**-2.57**
peuhl	-1.127	**-3.95**	-1.259	**-5.13**	-0.837	**-3.55**
other	-0.754	**-2.52**	-0.446	**-1.72**	-0.667	**-2.64**
Number of observations	4597		5466		6020	
Number of villages	109		137		150	
Minimum obs per village	9		7		8	
Average obs per village	42.2		39.9		40.1	
Maximum obs. per village	111		111		111	

Table 6. Descriptive statistics on paired data

	Burkina Faso		Senegal	
Group membership	Mean	St.dev.	Mean	St.dev.
% households in same RPO	29.8%		67.6%	
% with at least one male in same RPO	22.4%		32.5%	
% with at least one female in same RPO	13.0%		54.7%	
number of common RPOs for household	0.37	0.61	1.02	0.89
number of common RPOs for males	0.23	0.43	0.38	0.59
number of common RPOs for females	0.13	0.34	0.62	0.62
Distance				
Physical distance	9.37	6.54	9.37	8.02
Same ethnicity dummy	0.86	0.34	0.90	0.30
Absolute difference in household characteristics				
log(number of household members)	0.63	0.50	0.58	0.48
female head dummy	0.04	0.20	0.14	0.34
age of head	17.02	13.44	15.49	12.01
education level of head	0.57	1.24	0.97	1.73
economic status (1=poor to 4=rich)	0.98	0.88	0.74	0.83
family ties with authorities (index 0 to 4)	0.56	0.81	0.59	0.83
log(owned land +1)	0.52	0.57	0.42	0.49
log(nber of donkeys+1)	0.39	0.48	0.40	0.51
log(nber of cows+1)	0.87	0.95	0.60	0.91
log(nber of goat and sheep+1)	1.12	0.98	0.98	0.96
Sum of household characteristics				
log(number of household members)	3.63	0.92	4.28	0.91
female head dummy	0.04	0.21	0.17	0.41
age of head	88.51	23.36	101.51	21.46
education level of head	0.68	1.44	1.53	2.19
economic status (rank 1 to 4)	4.14	1.45	3.95	1.39
family ties with authorities (index 0 to 4)	1.52	1.63	1.59	1.47
log(owned land +1)	2.25	1.04	1.94	1.23
log(nber of donkeys+1)	0.68	0.76	1.30	1.56
log(nber of cows+1)	1.57	1.56	0.90	1.41
log(nber of goat and sheep+1)	2.91	1.86	2.53	1.92
Village characteristics				
number of wells	3.68	7.68	2.32	3.12
ethnic fractionalization index	0.22	0.24	0.11	0.17
market in village	0.31	0.46	0.33	0.47
electricity in village	0.03	0.17	0.29	0.45
village accessible in rainy season	0.47	0.50	0.66	0.48
log(# RPOs/# village inhabitants)	-5.95	0.83	-5.84	0.73
log(average household size)	2.11	0.54	2.19	0.35
log(number of RPOs in village)	1.01	0.77	0.88	0.65
Number of observations	698906		359470	

Table 7A. Dyadic logit regressions – Burkina Faso

	Any member is in a RPO			Male member is in a RPO			Female member is in a RPO		
		dyadic robust	vill.clust. robust		dyadic robust	vill.clust. robust		dyadic robust	vill.clust. robust
Distance	**Coef.**	**z stat.**	**z stat.**	**Coef.**	**z stat.**	**z stat.**	**Coef.**	**z stat.**	**z stat.**
Physical distance	-0.050	**-10.41**	**-5.42**	-0.050	**-12.76**	**-4.92**	-0.053	**-11.25**	**-4.72**
Same ethnicity dummy	0.852	**5.40**	**3.03**	0.773	**7.57**	**2.66**	1.233	**8.07**	**2.78**
Difference in household characteristics									
log(number of household members)	-0.095	-1.61	**-1.93**	-0.121	**-2.89**	**-2.33**	-0.080	-1.47	-1.24
female head dummy	-0.126	-0.86	-0.68	-1.259	**-3.82**	**-3.74**	0.223	**2.10**	**1.74**
age of head	-0.006	**-2.82**	**-2.94**	-0.004	**-2.99**	**-2.06**	-0.008	**-4.18**	**-2.46**
education level of head	-0.005	-0.21	-0.25	0.001	0.03	0.03	-0.043	**-1.73**	-1.44
economic status (from 1=poor to 4=rich)	-0.026	-0.94	-0.64	-0.014	-0.70	-0.32	-0.051	**-1.88**	-1.17
family ties with authorities (index 0 to 4)	-0.135	**-2.63**	**-1.77**	-0.114	**-3.61**	-1.37	-0.080	**-1.97**	-0.68
log(owned land +1)	0.151	**2.95**	**1.86**	0.207	**5.53**	**2.51**	0.046	0.94	0.44
log(nber of donkeys+1)	-0.100	**-1.80**	-1.58	-0.067	**-1.68**	-1.08	-0.099	-1.63	-1.04
log(nber of cows+1)	-0.066	**-2.11**	**-1.69**	-0.062	**-2.42**	-1.44	-0.033	-1.23	-0.92
log(nber of goat and sheep+1)	-0.028	-1.12	-1.13	-0.033	**-1.75**	-1.36	0.050	**2.15**	1.47
Sum of household characteristics									
log(number of household members)	0.223	**3.80**	**2.64**	0.140	**3.25**	1.51	0.166	**3.26**	**1.85**
female head dummy	-0.072	-0.42	-0.32	-0.376	-1.58	-1.18	-0.340	-1.39	**-1.73**
age of head	-0.001	-0.40	-0.42	-0.004	**-2.99**	**-2.23**	0.005	**2.94**	**2.16**
education level of head	-0.020	-0.54	-0.66	-0.034	-1.44	-1.14	0.026	0.71	0.57
economic status (rank 1 to 4)	0.039	1.02	0.64	0.020	0.72	0.32	0.077	**2.19**	1.10
family ties with authorities (index 0 to 4)	0.155	**4.38**	**2.68**	0.149	**7.15**	**2.33**	0.232	**9.40**	**3.24**
log(owned land +1)	0.153	**3.25**	**2.07**	0.045	1.36	0.62	0.126	**3.03**	1.45
log(nber of donkeys+1)	0.079	1.30	0.88	0.063	1.40	0.69	-0.064	-1.13	-0.70
log(nber of cows+1)	0.043	1.16	0.75	0.071	**2.53**	1.12	0.040	1.40	0.85
log(nber of goat and sheep+1)	-0.031	-1.25	-0.80	-0.019	-1.02	-0.50	-0.023	-0.92	-0.47
Village characteristics									
number of wells	0.015	**2.71**	1.23	0.015	**3.40**	1.30	0.001	0.10	0.04
ethnic fractionalization index	1.399	**5.36**	**2.77**	1.334	**8.02**	**2.57**	1.117	**4.91**	**1.69**
market in village	0.375	**2.51**	1.23	0.336	**3.49**	1.11	0.386	**3.02**	1.03
electricity in village	-1.503	**-6.31**	**-2.57**	-1.519	**-6.09**	**-1.91**	-1.667	**-4.92**	**-2.67**
village accessible in rainy season	0.141	1.32	0.60	0.124	1.64	0.53	0.291	**2.78**	0.91
log(# RPOs/# village inhabitants)	0.861	**10.25**	**5.33**	0.705	**11.88**	**4.43**	0.859	**11.95**	**4.40**
log(average household size)	0.685	**6.75**	**3.18**	0.505	**7.71**	**2.61**	0.444	**4.51**	1.55
log(number of RPOs in village)	-0.560	**-5.88**	**-2.37**	-0.426	**-5.58**	**-1.67**	-0.626	**-7.84**	**-2.81**
Intercept	1.289	**2.54**	1.27	1.157	**2.89**	1.16	-0.098	-0.21	-0.09
Pseudo R-squared	0.121			0.101			0.127		
Number of observations	681786			681786			681786		
Number of villages	241			241			241		

Table 7B. Dyadic logit regressions – Senegal

	Any member is in a RPO			Male member is in a RPO			Female member is in a RPO		
		dyadic robust	vill.clust. robust		dyadic robust	vill.clust. robust		dyadic robust	vill.clust. robust
Distance	**Coef.**	**z stat.**	**z stat.**	**Coef.**	**z stat.**	**z stat.**	**Coef.**	**z stat.**	**z stat.**
Physical distance	-0.007	-0.70	-0.76	-0.004	-0.87	-0.57	-0.008	**-1.98**	-1.13
Same ethnicity dummy	0.096	0.41	0.49	0.008	0.06	0.04	0.052	0.37	0.29
Difference in household characteristics									
log(number of household members)	-0.218	**-1.75**	**-3.04**	-0.155	**-2.21**	**-2.14**	-0.216	**-3.24**	**-3.32**
female head dummy	0.021	0.13	0.28	-0.511	**-3.29**	**-3.88**	-0.264	**-1.97**	**-2.36**
age of head	0.005	1.02	**1.73**	0.005	**2.14**	**1.74**	0.005	**2.20**	**2.24**
education level of head	-0.090	**-2.04**	**-2.10**	-0.036	-1.44	-0.99	-0.078	**-2.86**	**-2.22**
economic status (1=poor to 4=rich)	0.040	0.53	0.46	-0.007	-0.17	-0.08	0.100	**2.47**	1.53
family ties with authorities (index 0 to 4)	0.083	1.20	1.23	0.042	1.05	0.61	0.079	**2.17**	1.38
log(owned land +1)	-0.357	**-2.61**	**-3.07**	-0.238	**-3.06**	**-2.24**	-0.217	**-2.95**	**-2.13**
log(nber of donkeys+1)	-0.034	-0.24	-0.45	-0.031	-0.41	-0.36	-0.024	-0.36	-0.41
log(nber of cows+1)	0.048	0.74	0.90	0.183	**4.50**	**2.14**	-0.021	-0.56	-0.44
log(nber of goat and sheep+1)	-0.067	-1.09	**-1.83**	-0.066	**-2.07**	-1.35	-0.059	**-1.78**	**-1.74**
Sum of household characteristics									
log(number of household members)	0.239	**2.19**	**2.19**	-0.047	-0.78	-0.43	0.252	**4.57**	**3.13**
female head dummy	-0.352	-1.55	**-1.80**	-0.040	-0.23	-0.20	-0.548	**-3.29**	**-2.68**
age of head	-0.002	-0.46	-0.69	-0.005	**-2.21**	**-1.75**	0.000	0.04	0.04
education level of head	0.014	0.28	0.34	-0.022	-0.84	-0.57	0.036	1.27	1.00
economic status (rank 1 to 4)	-0.063	-0.76	-0.76	-0.088	**-2.13**	-1.09	-0.018	-0.45	-0.30
family ties with authorities (index 0 to 4)	0.076	0.99	1.17	0.049	1.07	0.64	0.054	1.35	0.97
log(owned land +1)	0.284	**2.67**	**2.63**	0.306	**5.94**	**2.43**	0.268	**5.93**	**3.21**
log(nber of donkeys+1)	0.007	0.09	0.07	-0.038	-1.02	-0.41	0.014	0.39	0.18
log(nber of cows+1)	-0.125	-1.50	**-1.81**	-0.173	**-3.90**	**-1.80**	-0.104	**-2.38**	**-1.70**
log(nber of goat and sheep+1)	0.171	**2.63**	**2.35**	0.219	**7.13**	**3.37**	0.142	**4.86**	**2.78**
Village characteristics									
number of wells	0.061	1.50	1.14	0.021	1.26	0.48	0.060	**2.73**	1.45
ethnic fractionalization index	-0.915	-1.22	-0.95	-0.277	-0.79	-0.31	-1.873	**-4.80**	**-2.51**
market in village	0.594	**1.73**	1.30	0.455	**2.90**	1.19	0.426	**2.80**	1.29
electricity in village	0.210	0.71	0.40	0.866	**5.22**	**1.94**	-0.176	-1.22	-0.46
village accessible in rainy season	-0.801	**-1.75**	**-1.91**	-1.067	**-5.35**	**-2.31**	-0.565	**-3.42**	**-1.92**
log(# RPOs/# village inhabitants)	0.190	0.81	0.65	0.281	**2.27**	1.21	0.006	0.08	0.03
log(average household size)	0.163	0.43	0.42	0.216	1.08	0.49	0.386	**2.50**	1.31
log(number of RPOs in village)	-1.254	**-6.25**	**-3.55**	-0.027	-0.27	-0.09	-1.050	**-11.16**	**-4.01**
Intercept	1.675	1.21	0.89	0.944	1.37	0.60	-0.933	-1.57	-0.70
Number of observations	350274			350274			350274		
Number of villages	196			196			196		

Table 8A. Dyadic village fixed effect regressions – Burkina Faso

A. Burkina Faso	# RPOs to which hh belongs			# RPOs of male hh members			# RPOs of female hh mbers.		
		dyadic robust	vill.clust. robust		dyadic robust	vill.clust. robust		dyadic robust	vill.clust. robust
Distance	**Coef.**	**z stat.**	**z stat.**	**Coef.**	**z stat.**	**z stat.**	**Coef.**	**z stat.**	**z stat.**
Physical distance	-0.006	**-8.75**	**-6.40**	-0.004	**-7.96**	**-4.85**	-0.003	**-7.23**	**-5.40**
Same ethnicity dummy	0.264	**10.25**	**3.57**	0.151	**10.63**	**4.17**	0.100	**7.32**	**2.49**
Difference in household characteristics									
log(number of household members)	-0.030	**-3.96**	**-3.15**	-0.015	**-2.89**	**-2.13**	-0.015	**-3.56**	**-2.96**
female head dummy	-0.073	**-3.35**	**-2.55**	-0.125	**-4.88**	**-4.03**	-0.009	-0.83	-0.56
age of head	-0.001	**-2.86**	**-1.97**	-0.000	**-2.21**	-1.53	-0.000	**-2.52**	**-1.93**
education level of head	-0.004	-1.22	-1.31	-0.003	-1.11	-1.12	-0.001	-0.47	-0.64
economic status (from 1=poor to 4=rich)	-0.008	**-2.33**	-1.11	-0.008	**-3.12**	-1.19	-0.005	**-2.43**	**-1.87**
family ties with authorities (index 0 to 4)	-0.045	**-6.28**	**-1.81**	-0.023	**-5.22**	**-1.76**	-0.024	**-6.29**	**-1.83**
log(owned land +1)	-0.002	-0.31	-0.20	0.002	0.52	0.32	-0.000	-0.01	-0.01
log(nber of donkeys+1)	0.001	0.17	0.15	0.002	0.50	0.37	0.001	0.14	0.14
log(nber of cows+1)	-0.010	**-2.36**	-1.63	-0.008	**-2.45**	-1.36	-0.004	-1.65	-1.24
log(nber of goat and sheep+1)	-0.014	**-3.85**	**-2.93**	-0.008	**-3.31**	**-2.62**	-0.003	**-1.88**	-1.58
Sum of household characteristics									
log(number of household members)	0.058	**8.21**	**4.70**	0.028	**5.85**	**3.29**	0.032	**8.03**	**4.89**
female head dummy	-0.124	**-3.67**	**-2.22**	-0.095	**-2.65**	-1.63	-0.041	**-2.23**	**-1.75**
age of head	-0.001	**-4.94**	**-2.94**	-0.001	**-5.78**	**-3.52**	-0.000	**-1.95**	-1.17
education level of head	0.004	0.86	0.99	0.001	0.48	0.48	0.002	0.78	1.04
economic status (rank 1 to 4)	0.012	**2.27**	1.25	0.012	**3.46**	**1.71**	0.005	**1.69**	**1.67**
family ties with authorities (index 0 to 4)	0.060	**8.09**	**2.97**	0.033	**7.65**	**3.13**	0.024	**6.29**	**2.54**
log(owned land +1)	0.031	**4.18**	**2.90**	0.015	**3.11**	**2.46**	0.012	**3.10**	**1.98**
log(nber of donkeys+1)	0.000	0.03	0.02	-0.002	-0.34	-0.26	-0.004	-0.76	-0.63
log(nber of cows+1)	0.003	0.57	0.35	0.003	0.80	0.37	-0.001	-0.29	-0.26
log(nber of goat and sheep+1)	0.014	**3.28**	**2.19**	0.008	**2.91**	**2.39**	0.004	**2.01**	1.41
Intercept	-0.056		-0.77	0.014		0.32	-0.072		-1.59
Number of observations	683306			683306			683306		
Number of villages	243			243			243		

Table 8B. Dyadic village fixed effect regressions – Senegal

	# RPOs to which hh belongs			# RPOs of male hh members			# RPOs of female hh mbers.		
		dyadic robust	vill.clust. robust		dyadic robust	vill.clust. robust		dyadic robust	vill.clust. robust
Distance	**Coef.**	**z stat.**	**z stat.**	**Coef.**	**z stat.**	**z stat.**	**Coef.**	**z stat.**	**z stat.**
Physical distance	-0.002	**-3.45**	**-1.97**	-0.001	**-1.86**	-1.46	-0.002	**-3.58**	-1.65
Same ethnicity dummy	0.108	**3.50**	**2.50**	0.059	**3.27**	**2.48**	0.069	**3.28**	**2.56**
Difference in household characteristics									
log(number of household members)	-0.052	**-4.92**	**-4.35**	-0.023	**-3.07**	**-2.67**	-0.036	**-4.35**	**-4.02**
female head dummy	-0.059	**-4.66**	**-3.14**	-0.175	**-7.98**	**-3.93**	-0.078	**-5.33**	**-3.93**
age of head	-0.000	-1.04	-1.03	-0.000	-0.33	-0.31	0.000	0.63	0.53
education level of head	-0.013	**-3.36**	**-3.01**	-0.007	**-2.94**	**-2.78**	-0.008	**-2.51**	**-2.56**
economic status (from 1=poor to 4=rich)	-0.002	-0.37	-0.32	-0.004	-0.96	-0.75	-0.001	-0.29	-0.22
family ties with authorities (index 0 to 4)	-0.003	-0.80	-0.49	-0.002	-0.55	-0.46	0.000	0.09	0.06
log(owned land +1)	-0.036	**-2.99**	**-2.25**	-0.016	**-2.04**	**-1.71**	-0.015	**-1.72**	-1.51
log(nber of donkeys+1)	-0.039	**-2.88**	**-2.88**	-0.026	**-2.96**	**-3.26**	-0.026	**-2.66**	**-2.59**
log(nber of cows+1)	0.006	1.27	0.90	0.002	0.74	0.63	0.005	1.18	0.82
log(nber of goat and sheep+1)	-0.014	**-2.97**	**-2.40**	-0.009	**-2.74**	**-2.62**	-0.009	**-2.44**	**-1.90**
Sum of household characteristics									
female head dummy	-0.025	-1.57	-1.06	0.068	**3.24**	1.60	-0.078	**-4.90**	**-2.72**
age of head	-0.000	-0.97	-0.98	-0.001	**-2.37**	**-2.10**	0.000	0.60	0.52
education level of head	0.003	0.78	0.80	0.002	0.96	1.03	-0.000	-0.03	-0.03
economic status (rank 1 to 4)	0.009	1.53	1.19	0.004	1.02	0.76	0.004	0.74	0.55
family ties with authorities (index 0 to 4)	0.009	1.56	0.89	0.003	0.78	0.48	0.006	1.23	0.95
log(number of household members)	0.086	**8.98**	**6.19**	0.023	**3.44**	**2.97**	0.072	**9.55**	**7.21**
log(owned land +1)	0.063	**5.64**	**3.26**	0.037	**5.05**	**3.36**	0.026	**3.18**	**2.14**
log(nber of donkeys+1)	0.020	1.56	1.34	0.010	1.21	1.12	0.013	1.40	1.34
log(nber of cows+1)	-0.014	**-2.05**	-1.49	-0.003	-0.73	-0.65	-0.012	**-2.13**	-1.49
log(nber of goat and sheep+1)	0.005	1.07	0.72	0.003	0.79	0.66	0.004	1.10	0.92
Intercept	0.508		5.18	0.235		4.75	0.225		3.16
Number of observations	350274			350274			350274		
Number of villages	196			196			196		

Figure 1. Difference in means

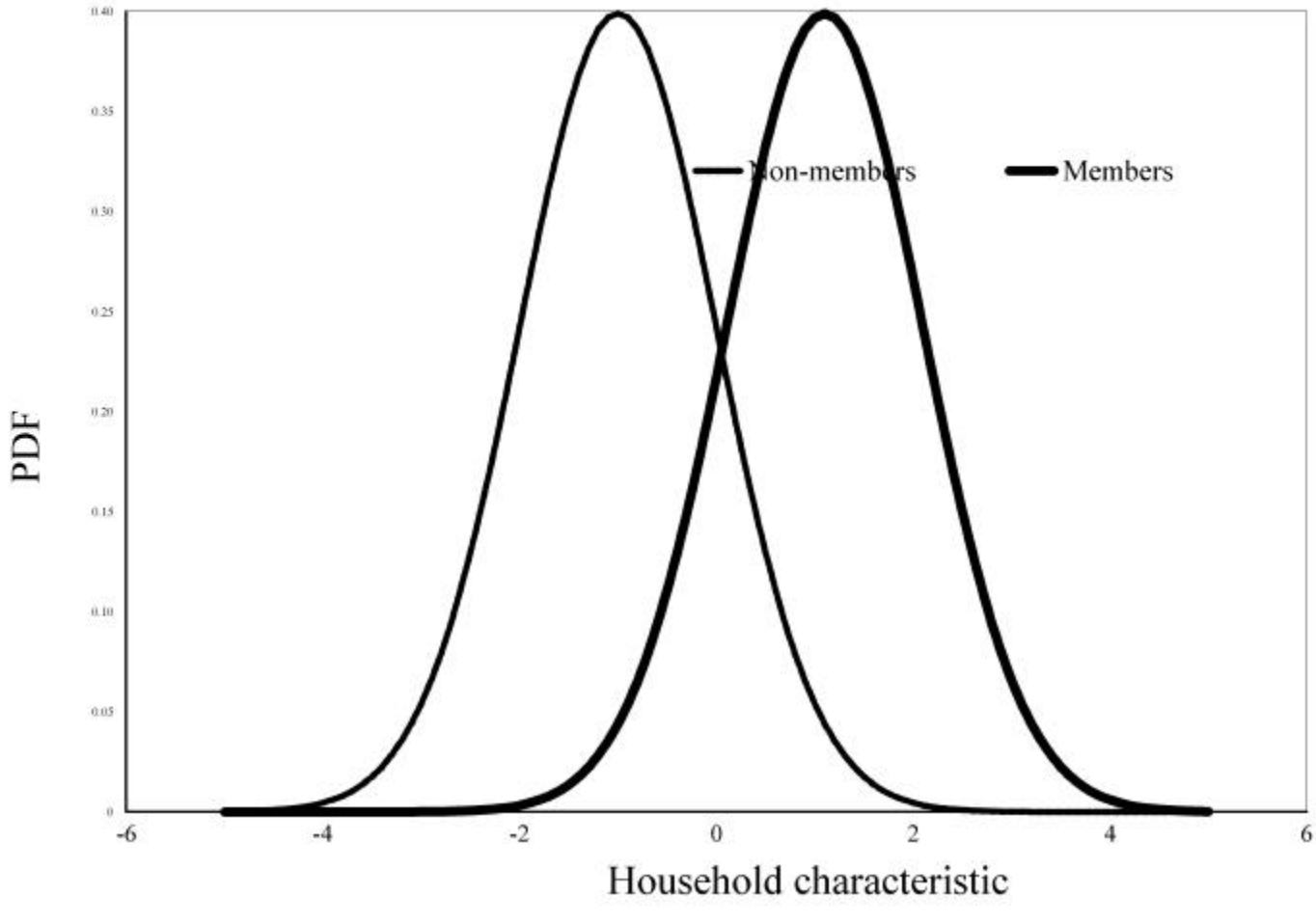

Figure 2. Members more similar