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Determinants of Group Participation: Option and Impact of Farmers' Participation in Groups in Mbozi District

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Abstract

This paper explores factors that determine farmers' participation in groups in Mbozi district, Tanzania. Cross-section data used were obtained from face-to-face interviews from a sample of 310 households and 21 farmer groups. Analysis was done by using non-linear logit model and Instrumental Variable. The findings show that type of group, trustworthiness, transaction cost, marital status and the kind of institution initiating group formation are significant determinants of farmers' participation in groups. The results further show that the average expected income accrued from group participation is Tanzanian Shillings 87,768 more than that obtained by non-participants.

Key words: farmers' groups' participation, smallholder farmers, transaction costs, farmer and group choice

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1.0 Introduction

This paper presents and discusses factors that have influence in determining the decision by farmers to join group in efforts to improve farming and increased farm productivity. It is expected that a farmer's decision to join a community group or not is influenced by a multitude of factors: socioeconomic characteristics at the household/farm level, production, group characteristics, as well as personal attitudes towards and experiences from outward looking of the existing groups. Unobservable characteristics affecting the decision to become a member are correlated with the unobservable characteristics affecting a farmer's level of satisfaction with his/her group membership.

Although, it is clear that farmers are joining and using agricultural based organizations in agricultural service delivery and much anecdotal evidence exists on that (Barham *et al*, 2008; Luis, 2007; Willer, 2009) there are very few empirical data-oriented studies using mathematical and computational models that have been documented based on empirical analysis of factors that have influenced farmers to participate in particular CBOs. In this respect, the notion for determining factors to participate is of preponderance importance. What are the important issues considered by farmers or individual citizens to arrive at a decision to participate? The emerging policy recommendations is aimed at informing both government and the farmers to better understand and appreciate the quality and nature of their relationships, and to see ways to enhance their interactions and dealing with market coordination failure.

Partial withdrawal by the state from providing goods and services and further privatization and decentralization of government functions have created possibilities for Farmer based Organizations (FBOs) to become service providers themselves, or share in the costs of service provision (Bertus *et al*, 2006). This has placed renewed attention on institutions of collective action - most often realized through the structure of Farmer Groups (FGs)—as an important and efficient grass root mechanism for enhancing smallholder farmer's income (Barhan, *et al*, 2008). The smallholder organizations through farmer groups are seen as a possible institutional solution to overcome high transaction costs and other market failures in rural development economies (Fischer *et al.*, 2011).

This study has quantitative models to investigate farmers' options to participate in groups. The paper presents results in this area particularly at the grass-root level as an attempt to explore the workings of collective action. This has been considered as a research gap, which we address in the present paper. The identification of factors that underpin self-managing of FGs is particularly pertinent for Tanzania, that have undergone a high level of decentralization process. The overriding hypothesis of the paper is that the participation of smallholder farmers in groups is influenced by both socio-cultural and socio-economic characteristics of a farmers and factors outside farmers' control.

This study uses cross-section data obtained from face-to-face interviews from a sample of 310 households and 21 farmer groups in Mbozi. Analysis was done by using non-linear logit model and Instrumental Variable. The findings show that type of group, trustworthiness, transaction cost, marital status and the kind of institution initiating group formation are significant

determinants of farmers' participation in groups. The results further show that the average expected income accrued from group participation is Tanzanian Shillings 87,768 more than that obtained by non-participants.

The remainder of this study is organized as follows. Section two provides the methodology to be used in this study. Section three reports and discusses the econometric results. Section four gives conclusion and policy implications.

2.0 Methodology and Data

2.1 Sampling and Methods

The empirical study on which this study is based was conducted in Mbozi District in the Southern Highlands of Tanzania. The district was selected because it is among the agricultural potential districts and where diagnostic survey indicated that there are concentrations of farmers' groups¹¹ (FGs). It was selected in the premise that this is the area where one would see increased agricultural services in terms of operation of private service providers (stockists), well established farmers groups as compared to other potential districts. 19 villages were covered with a sample size of 310 farmers.

Cross-section data was collected using a questionnaire survey administered to farmers based on face-to-face interviews. Sampling was done for group and non-group participants as dictated by the application of logistic regression. The sample size of the present study accorded the published tables in determining sample size (see in Glenn, 2009). The analysis was carried out utilizing fitted cross-section data from Mbozi district of 310 household data in non-linear econometric model (logit) to determine factors of farmers' participation in FGs. A Logit model is a regression technique that has been shown to be appropriate for examining qualitative dependent variables (such as participation), and permits their interpretation as probability (Nkuba, 2007; Heckamn 1995).

2.2 Empirical models

Several literature documents that the model used to examine relationship between participation and determinants of participation involves a mixed set of qualitative and quantitative analyses. Alternative specifications of qualitative choice models include the linear probability models: the Probit model and the Logit model ((Maddala, 1983). These are the two most frequently used applications in explaining the socio-economic phenomena, especially for analyzing the relationship between dependent discrete variables (adoption / participation) and explanatory variables (Pascal *et al.*, 2001).

The important variables were selected *a priori* based upon their theoretical or material role in the decision process being modeled - the model choice. The dependent variable in the empirical model is whether or not the farmer participated in a group. Overall, model tests are conducted to determine if the variables or variable transformations that was followed offers an improvement.

¹¹ We also sampled and interviewed non-group members, for the purpose of this analysis

It is hypothesized that there are both internal and external factors that have effect on the decision of farmers to participate Farmer Groups. The internal factors would include farmers' characteristics (e.g age, education, sex, etc, while external factors include farm resources, farming system, access to information, contractual agreements, etc. Building on the approaches used by Shiferaw *et al* (2005) and Barhan *et al* (2006) the model for the participation of farmers in groups is constructed as:

$$\ln\left(\frac{D_i}{1-D_i}\right) = \beta_0 + \beta_1 Fc_i + \beta_2 E_i + \varepsilon_i \quad (1)$$

In this case, Fc_i and E_i are denoted as internal and external factors respectively that will determine an outcome. Each factors is assigned a score value for incorporation in the model. As is always the case, the parameters of the model are estimated using the maximum-likelihood method. The aim of maximum likelihood estimation is to find the parameter value(s) that makes the observed data most likely.

Thus, the data was regressed against dependent binary variable of group participation (variable: MEMBOR) in order to identify the factors influencing participation. To estimate the probability of participation between the two groups more specifically it is expressed as:

$$\Pr ob(MEMBOR = 1) = \frac{1}{1+e^{-Z_j}} \quad (2)$$

$$Z_j = \beta_0 + \sum_{j=1}^n x_j \beta + \mu_{1j}$$

Where, MEMBOR= a dichotomous dependent variable (1 if participation takes place, 0 Otherwise), X_i includes vector of variables included in the model (of the variables included in the model, positive relationships was expected), β_i = parameters to be estimated, μ_{1j} stands for error term which is normally distributed with zero mean and constant variance of σ^2 , the disturbance term captures all unmeasured variables that influence the likelihood of the farmer's decision to participate in groups, e = base of natural logarithms. If some of z is endogenous, the logit parameter estimates are not consistent.

The study extends its scope in analysis of the determinants of participation (equation 3) which was followed by estimation of the impact outcomes of joining the groups – (i.e. treating participation as an exogenous¹² variable (in order to find the reverse causal relationship). Their participation of farmers was tested with a treatment¹³ effects model as defined and employed in

¹² A variable is said to be exogenous in a causal model or system if its value is influenced by factors not included in the model.

¹³ Here the term treatment as it is used can stand for social intervention (e.g group participation as in the present study), public policies, medical treatment, etc.

different ways by Maddala (1983), Heckman(1995) and Shiferaw (2005). This model is widely known as Instrumental Variable (IV) method, which fits treatment effects models using either Heckman's two-step consistent estimator or full maximum-likelihood (for details see in Basu et al (2007); Nkuba (2007); Basu et al (2007)). The treatment effects model considers the effect of an endogenously chosen binary treatment on another endogenous continuous variable, conditional on two sets of independent variables. The endogenously chosen binary treatment is the decision to join the groups.

The application of IV method helps to control for the potential endogeneity of use and accrued outcomes. Variables are used as instruments that affect participation but not the impacts of participation decision. The two-equation system enables the identification of the determinants of joining groups as in logistic regression model, on the one hand, and the characteristics influencing impact of participation on the other. Thus the Instrument variables model is expressed as:

$$y_i = a + \beta x_i + \lambda Z_i + \varepsilon_i \quad (4)$$

Equation 4 shows that the impact, or continuous outcome y_i , is conditional on a set of independent variables x_i and the endogenous dummy variable Z indicating whether the treatment has been assigned or not. Equation (4) estimates mean impact indicators for participants while equation (5) estimates the mean impact indicators for non-participants.

$$y_i = a + \beta x_i + \varepsilon_i \quad (5)$$

Where a , β and λ are parameters. x_i , that stands for the control variables such age, education, household size, farm size, trust, organization type, condition to join, marital status, household assets, etc. ε_i denotes residuals that include other determinants of participants and measurement errors. The estimates of λ give the impacts of group participation.

The study employed a logit regression analysis to identify factors that determine farmers' decision to join a group. It is posited that as the sample size grows the sampling distribution of estimated parameters approaches the t-distribution. Thus, variables entered into the logit model were evaluated statistically using t-statistics and jointly using the log likelihood ratio test (see goodness of fit). The variables were selected *a priori* based upon their theoretical or material role in the decision process being modeled. The dependent variable in the empirical model was whether or not the farmer participated in a group. Overall, model tests were conducted to determine if the variables or variable transformations that were followed offered an improvement.

2.3 Data

While selecting the variables to be included in the model, attempt has been made to include the most important factors that accords to collective actions theory and most importantly the hypothesis advanced. For a farmer to decide to join a group is an outcome of a number of endogenous and exogenous factors. There are two types of variables: the continuous and dummy variables. The dependent variable is group participation “MEMBROR” i.e whether a farmer participate or did not participate. This outcome was named as DMEMBOR1 based on dummy variables generation literature. As is always the case with logit and probit models (non-linear regression), the categorical variables were converted into dummy variables (i.e 1/0) using Stata program.

The covariates of DMEMBOR1 were identified a priori based on literature review of collective action and social capital (see Table 1). They were arrived at after several trials of running logit and probit models. All of the variables that were collected were transformed or manipulated to be able to fit into the specified model. Those variables that could not fit well in the model were dropped. The study extended its scope to investigate the welfare effect from group participation with the application of Instrumental Variable (IV) Method (see section 3.2).

3.0 Results and Discussions

3.1 Logistic and probit regression analysis: participation equation

The estimation procedure provides numerical approximations for the maximum likelihood estimates of β , and the values of the partial derivatives of participation with respect to the explanatory variables. Running the logit model using STATA 11, the results are as in Table 1. Since logistic regression calculates the probability or success over the probability of failure, the results of the analysis are in the form of an odds ratio (i.e the odds of the ratio that farmers participation in group will occur). Both the Probit and Logit models yielded similar parameter estimates and it is difficult to distinguish them statistically.

The coefficients in this model are tested by the Wald statistics, which has a Chi-square distribution and t statistics. However, we have to keep in mind that the relationship between the probabilities and the predictors is not a linear relationship. The likelihood ratio chi-square of 136.60 (df=9) with a p-value of 0.000 tells that the model as a whole fits significantly better than an empty model (i.e., a model with no predictors). The results from both logit and probit confirm that with fitted cross-section data from Mbozi district the type of group, trustworthiness as indicator of social capital, village distance as proxy indicator of transaction cost, marital status and a kind of institution initiating group formation were significant determinants of farmers participation in groups.

Table 1: Determinants of Farmers' participation in groups: a logit and probit models

Variable	logit results		Probit results	
	Coefficient	S.Ea	Coefficient	S.Ea
Age	0.118***	0.066	0.068***	0.040
Sex	2.489	2.268	1.428	1.315
agricultural based group (agricultural-based: 1=yes, 0=otherwise)	-8.884***	4.481	-5.070***	2.463
distance from household to group collection centre	14.512***	5.348	8.447***	3.129
trust of the group (1=yes, 0=otherwise)	5.588***	2.562	3.159***	1.480
conditionality to participate (1=yes, 0=otherwise)	-0.852	1.599	-0.477	0.905
external agency initiating group formation (1=yes, 0=otherwise)	-4.950***	2.036	-2.750***	1.119
marital status of farmers (1=married, 2=single)	3.903***	2.141	2.182***	1.136
farmers asset index	0.009	0.009	0.005	0.005
constant	-2.857	3.904	-1.716	2.134
Log likelihood = -9.669				
Number of observation = 124				
Likelihood Ratio Chi square = 136.60				
Probability > Chi square = 0.0000				
Pseudo R-square = 0.8760				

Key: *, **, *** denoteS significance at the 10%, 5%, and 1% level
S.Ea Cluster robust standard errors

Below, we discuss the implications of the findings as relates to collective action initiatives and policy implications.

Type of group: The model predicts that probability of farmers joining a group would be lower if the type of group is agricultural-based compared to other types of groups. This finding would be expected as most of the farmers and groups interviewed had more interest in groups that provide loans such as credit and saving scheme and village cooperative banks (VICCOBA). For instance, from descriptive analysis about 55.9 % of the group participants had joined savings and credit scheme groups, which was statistically significant.

Trust: Literature elsewhere describes trust as the belief that the result of somebody's or group's intended action will be appropriate from community point of view. It is demonstrated that when relationships are high in trust, farmers are more willing to engage in social exchanges and cooperative interactions – embracing less on knowledge acquisition and more on affiliation or reputation, and self-expression. From these findings, therefore, trust is relevant to bring about social unity and characterizes communities with strong social capital and encourages members to interact or even help others in the same community or group.

Marital status: As can be seen from Table 1, marital status significantly is associated with group participation. One of the most important factors affecting the level of production and productivity on peasant farms is the composition and size of farming family. The statistical result of this study is not surprising, considering the findings from many of studies having the highest percentage of married farmers. Married farmers are likely to be under pressure to produce more, not only for family consumption but also for sale to be able to take care of size of the family. The desire to produce more could lead to joining farmers groups in order to attain economies of scale but also social capital. Similarly, the availability of family labour could be an incentive to the married farmer to join groups using part of labour available in the household. Therefore, marital status is a principle determinant of farmers' participation in groups with the results showing that married couples have higher probability of joining a group than those who are single men and women including divorcees, widowed, and never married.

Village distance: Another important finding from the logit is that distance that a farmer has to travel to search information on a particular group does matter. However, the expected sign for the estimate of the variable is ambiguous. Results show that as distance increases, the likelihood of farmers joining groups' increases. However, this is contrary to the general expectation that as the group convening place goes farther away the farmers will be reluctant to joining groups. Nevertheless, the result of the present study may not be surprising, considering the fact that in the areas of study most of farmers or people are skeptical of joining a group which is within the village. Most of the farmers interviewed had joined group which were in a nearby villages. This kind of behavior which is apparent in some of the communities may need further investigation. The differences in the results of the present study and results of some of the previous ones may be accounted for by the variation in the personal, social, economic, and cultural backgrounds of the farmers who participated in these studies, as well as differences in time and environment.

External agency: Also of significance based on logit statistical results is that the type of agency initiating the process of group formation is an important parameter in influencing farmers' participation in groups. The results show that the probability of participation would be lower for community than for externally initiated groups. These findings are contrary to the general belief that locally initiated groups are more likely to be appreciated by individuals and therefore to decide to participate, and for that matter these groups are expected to be performing better than the externally initiated. On the other hand, this can be expected because with community initiated groups farmers were not exposed to group dynamic skills which is possible when an external agency is involved. For instance, as it was explained through group interviews undertaken, Techno-serve has had been building capacity of farmers – VICCOBA in such areas of entrepreneurial skills, conflict management in groups, group management, project write up and business strategic planning. These are motivational approaches for the farmers to join groups and that they are able to make groups became sustainable.

We argue that where local groups exist, the formation of new ones may only be justifiable if they complement with the existing groups. This complementarity can be focusing on the fulfillment of the functions that existing groups are not able to perform. This can be in terms of the need or weak structural functions of existing groups by incorporating new ideas. This entry point has shown to be appropriate, for instance, as revealed in Fischer et al (2011), during the formation of new banana groups in Kenya TechnoServe which is an International Non-Government Organization. Most of the new groups were formed building on existing local networks and social ties which resulted into an improved group performance and thus sustainability.

Only that the role of outsiders could help a group identify its problems, and might also offer possible solutions, but if these outsiders initiate the formation, experience elsewhere has shown that the sustainability is more difficult than when the insiders of the local community have initiated formation. There was a general consensus from the groups' discussion that farmers or individuals have a tendency to be too high expectations and hopes if the initiators were outsiders, and this could create some dependency, resulting in group members not maximizing on their own capacities.

Age of farmers: The age of the head of the household is observed to be positively associated with the farmers' likelihood to group participation. The present study findings regarding age of group members are consistent with Fischer et al (2011) that revealed to have influence attitudes towards collective action.

3.2 Impact analysis: Instrumental Variable Method

The same set of independent variables from the same dataset was maintained as a basis for making decision to participate to finding the reverse causal relationship. The impact equation was estimated using the actual observations for group participants, as well as the saved residuals from logit regression or participation equation (Table 1). The technique of instrumental variables estimation addresses some of the potential bias in estimating the causal effects of participation on farmers' welfare.

On estimating the farm income, the Instrumental Variable (IV) method showed that there was no statistical support of correlation between the errors of the impact equation and use equation, where the p-value was =0.518 for the residuals. These results accords or supported for the inclusion of the participation equation as an explanatory variable in the impact equation.

The results in Table 2 show that the average expected income realized by group participants is TSh 87,768.42 more than that obtained by non-participants. Notwithstanding, the results from the data available show that group participation has been more beneficial to farmer in groups than non-group participants. It implies, that the groups were able to generate net positive benefits for their members, i.e., for each member, the economic and social benefits of participation in the group did outweigh the costs of that participation - without this there simply would be no participation. These findings give an insight that an improvement in the group functioning is likely to bring about an improvement in the livelihoods of the large section of the population in Mbozi District, Tanzania.

Table 2: Impact of farmers participation in groups: Instrumental Variable Model

Variable	Coefficient	Standard Error
age	-8065.394	14236.66
sex	50408.840	344952.40
agricultural based group (agricultural-based: 1=yes, 0=otherwise)	759637.900	797743.60
distance from household to group meeting centre	-558971.100	468112.50
trust of the group (1=yes, 0=otherwise)	61280.970	504380.20
conditionality to participate (1=yes, 0=otherwise)	-10144.750	384986.30
external agency initiating group formation (1=yes, 0=otherwise)	-573469	524063.20
marital status of farmers (1=married, 2=single)	654278.700	475411.10
farmers asset index	3054.068	2467.82
Participation in group (1=yes, 2=no)	87,768.42	877113.50
Residuals from logit	-427119.800	53065.50
Constant	683811.100	1069285.00
Number of observations	= 119	
F-value (11,107)	= 0.99	
Prob > F	= 0.4627	
R-squared	= 0.0921	
Adj R-squared	= -0.0012	
Root MSE	= 1800000	

Key: all values of coefficients are non-significant

4. Conclusion and policy implications

In this paper, we used the standard logit model to analyze the farmers' discrete decision to participate in groups. The empirical results confirm that occupation, farmers' age, type of group, trustworthiness as indicator of social capital, village distance as proxy indicator of transaction cost, marital status and a kind of institution initiating groups are significant determinants of farmers participation in groups. We further extended the analysis into applying Instrumental Variable (IV) Method by factoring the same independent variables used in the logit model to finding the impact of group participation. The result shows that there is at least more income accrued from participants than non-group participants in farmers groups.

This suggests that, in order to have a significant effect of groups on economic welfare there is a need to expand their organizational and resource capacity to benefit more rural people by enabling more asset accumulation, higher asset productivity and knowledge base. This will stimulate rural income growth and this can further be enhanced by increasing social capital, inter-group trust, gender and type of groups which are critical factors explaining variation in group participation and household welfare. These can be realized if the farmers can overcome skepticism and negative attitudes toward groups that surfaced following the decline and malfunctions of cooperatives.

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