EFFECT OF MICROFINANCE ON SMALLHOLDER FARMERS' LIVELIHOOD IN RWANDA: A CASE STUDY OF NYAMAGABE DISTRICT

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ABSTRACT

Microfinance in Rwanda is considered as one of the most crucial mechanisms in the implementation of the Government program to reduce poverty and to increase economic growth. However, despite the effort made by the Government of Rwanda to put in place microfinance institutions in rural areas, little is known about the effects of microfinance on smallholder farmers' income in Nyamagabe District of Rwanda. This study aimed at examining the contribution of microfinance services to the income of smallholder farmers in Nyamagabe District. Primary data were collected from 240 respondents randomly selected in 3 sectors of Nyamagabe District using structured questionnaires. Data were analyzed using descriptive statistics to describe the socio-economic characteristics of the respondents and Propensity Score Matching was used to assess the effect of microfinance on smallholder farmers' livelihood. The results from descriptive statistics showing that 117 respondents were participants in microfinance services and 123 were non-participants and more men were committed to participate and to access microfinance services than women. Results from Propensity Score Matching Model using both Kernel Based Matching and Nearest Neighbor Matching showed that the households participating in microfinance services increased their total annual income by 256,674 Rwandan francs and 228,246 Rwandan francs more than non-participants, respectively. The study recommended that smallholder farmers should be encouraged to participate in microfinance services to increase their income and agricultural productivity. The use of SACCOs and microfinance services needs to be promoted in order to provide an instrument for mobilizing savings and extending credit.

Keywords: *Microfinance, Smallholder farmers, Livelihoods, Rwanda.*

INTRODUCTION

In developing countries, microfinance and microcredit programmes have changed the well being of smallholder farmers and have a positive effect on agricultural productivity (Abdullah, 2011; Asmamaw, 2014; Asadul Islam *et al*., 2015). In African countries and especially in Rwanda, microfinance institutions have contributed to standards of living of smallholder farmers and in the country's development. By its Vision 2020, the Government of Rwanda has implemented strategies and policies through microfinance programs for empowering rural community (Minecofin, 2012). MFIs have been seen as an opportunity to offer both financial services as well as education and training services to the farmers in a bid to improve their capacity and livelihood. The institutions have made significant evolution in providing the needed savings and credit facilities for the smallholder farmers thus raising their standard of living and have made substantial development of marketing relationships of farming communities (Duvendack, et al., 2011; North, 2012).   The provision of microfinance services facilitated rural household to improve in agricultural inputs and to increase their income generating non-farm activities **(**Hakim, 2004; Sherin, 2012).

Owuor (2009) stated that smallholder farmers' participant in microfinance credit improves household productive incomes. However, the Government of Rwanda's objectives in rural areas are to extend the leading edge of sustainable microfinance to overcome cost barriers and risks, by encouraging saving mobilization, and improving technology.

Despite the efforts made by the Rwandan Government to support the implementation of microfinance to reduce poverty, the majority of smallholder farmers still having challenges to access microfinance services for their economic development and little is known about the effect of microfinance on smallholder farmers' livelihood in Nyamagabe District. The study sought to analyze the effect of microfinance on smallholder farmers' livelihood in Nyamagabe District of Rwanda

MATERIAL AND METHODS

The study was carried out in Nyamagabe District, Southern Province of Rwanda. The major economic activity of the people is agriculture and the major crops grown are potatoes, beans, wheat, peas, maize, sweet potatoes, and tea. Data were collected using structured questionnaires that were administered to the sample of households' heads via person-interviews. The sample random sampling techniques were applied to select 240 smallholder farmers in three sectors of Nyamagabe District namely Gasaka, Kibirizi and Tare. The present study used both quantitative and qualitative methods. Data were analyzed by using both Statistical Package for Social Sciences (SPSS) Software version 18 and STATA 14.

The data were analyzed by using descriptive statistics and Propensity Score Matching Approach.

Descriptive statistics was used to describe the socio-economic characteristics of smallholder farmers in Nyamagabe District, Rwanda. In this case, frequencies were

presented in the analysis. The study used Propensity Score Matching (PSM) to estimate the effect of microfinance on smallholder farmers' livelihoods in Nyamagabe District. The propensity score is the conditional probability of participation in microfinance of given household characteristics. For using the PSM method, we referred to several studies (e.g., Rosenbaum and Rubin, 1983; Dehejia and Wahba, 2002; Caliendo and Kopeinig, 2005; Smith and Todd, 2005).

The function: $P\ (X)\ =\ Pr\ \{D\ =\ 1\backslash\ X\}\ =\ E\ \{D|\ X\}$ ……………………………….(1)

Where D = {0, 1} is the binary variable on whether a household has participated in microfinance services (1) or not (0). X is the multidimensional vector of relatively stable household characteristics in our context that if the exposure to microfinance is random within cells defined by X, it is also random within cells defined by p(X) or the propensity score (Rosenbaun and Rubin (1983). The matching approach purpose is to estimate the counterfactual outcome and to correct for the selection biases created by non-random sampling of the microfinance services participants (Dehejia and Wahba, 2002).

Estimation of the Average Treatment Effects on the Treated (ATT)
The study estimated the Average Effect of Treatment on the Treated (ATT). The expected value of ATT is defined as the difference between expected outcome values with and without treatment for those who actually participated in the treatment (Abadie, 2005).

To compute the ATT, two alternatives matching methods such as *Nearest Neighbor Matching* and *Kernel Matching* were used and compared to analyze the effect of microfinance on smallholder farmer's livelihoods. The estimates of ATT from the two matching algorithms were obtained usingthe *psmatch 2* command in Stata 14. The outcome variables is **''*Total Annual Income"***

Nearest Neighbor Matching
The simplest matching estimator is Nearest Neighbour (NN) Matching. With Nearest Neighbor, each treated group is matched with a control group (Caliendo & Kopeinig, 2008). A simplified formula to compute the estimated treatment effect using the Nearest Neighbor Matching can be written as:

$$ATT\ =\ \frac{1}{N^T}\left(\sum_{i\in T}Y_i^{\ T} - \frac{1}{N_i^{\ c}}\sum_{j\in c}Y_j^{\ c}\right)\ \text{………………………………………… (2)}$$

Where, N^T is the number of cases in the treated group and $N_i^{\ c}$ is a weighting scheme that equals the number of cases in the control group using specific algorithm. The consequence of this matching method is all treated units find matches and even for fairly poor propensity score of the control group (Becker and Ichino, 2002).

Kernel Based Matching

In kernel Based Matching, all treated subjects are matched with a weighted average of all controls using weights that are inversely proportional to the distance between the propensity scores of treated and control groups. The weighting value is determined by distance of propensity scores, bandwidth parameter h_n, and a kernel function K (.).

The Kernel Based Matching estimator is given by the formulation:

$$ATT^K = \frac{1}{N^T} \sum_{i \in T} \left\{ Y_i^T - \frac{\sum_{i \in c} Y_j^c \, G\left(\frac{P_j - P_i}{h_n}\right)}{\sum_{k \in c} G\left(\frac{P_k - P_i}{h_n}\right)} \right\}$$

……………………….. (3)

Where G (·) is a kernel function and h_n is a bandwidth parameter, under standard conditions on the bandwidth and kernel and the formulation below is consistent estimator of the counterfactual outcome $Y_{0i.}$

$$\text{Outcome} = Y_{0i} = \frac{\sum_{i \in c} Y_j^c \, G\left(\frac{P_j - P_i}{h_n}\right)}{\sum_{k \in c} G\left(\frac{P_k - P_i}{h_n}\right)}$$

……………………………….. (4)

Variables used in the Model

X_1 = hhgender : Gender of household head (1= Male, 0= Female), X_2 = hhage: Age of household head (in years) , X_3= sizeland: Land size , X_4 = hheduc : Education level of household head, X_5= HHsize : Size of Household , X_6 = hhmaritalst: Marital status of Household Head, X_7 = hhOccupat : Household main occupation , X_8 = Distance : Distance from homestead to microfinance office, X_9= Totalassets: Annual Total Assets, X_{10} = Percredel: Perception of credit eligibility, X_{11} : Off_farm_inc: Off- farm income

RESULTS AND DISCUSSIONS

Results from Descriptive Statistics
Participants and non-participants in microfinance services in Nyamagabe District

Table 1. Participants and non-participants by gender

Gender	Participants		Non-participants		Total	
	Frequency	Percent	Frequency	Percent	Frequency	Percent
Male	85	35.4	80	33.3	**165**	**68.7**
Female	32	13.4	43	17.9	**75**	**31.3**
Total	**117**	**48.8**	**123**	**51.2**	240	100

Source: Author, Field survey, 2011

Table 1. illustrates that in Nyamagabe District, more men were very committed to participate and access microfinance activities than women. The results show that 35.4 percent of men were participants in microfinance services while 33.3 percent were not participants and only 13.4 percent of women were participants and 17.9 percent were not participants respectively. Despite the improvement of microfinance programs for women empowerment, fewer women were participants in microfinance services.

Table 2. Smallholder Access to credit and access to Savings in three sectors of Nyamagabe District

Sectors	Access to Credit			Access to Savings		
	Yes	No	Total	Yes	No	Total
Kibilizi	23 (9.6%)	58 (24.1%)	81 (33.7%)	47 (19.6%)	34 (14.1%)	81 (33.7%)
Gasaka	17 (7.1 %)	61 (25.4%)	78 (32.5%)	54 (22.5%)	24 (10%)	78 (32.5%)
Tare	20 (8.3%)	61 (25.4%)	81 (33.7%)	50 (20.8%)	31 (12.9%)	81 (33.7%)
Total	60 (25%)	180 (75%)	240 (100%)	151 (62.9%)	89 (37.1%)	240 (100%)

Source: Author's survey, 2011

In order to analyze the participation in microfinance services by respondents in 3 sectors of Nyamagabe District, the respondents were asked to indicate whether they had ever accessed credit and savings services provided by microfinance institutions in Kibilizi, Gasaka and Tare Sectors. However, in Kibilizi Sector more smallholder farmers have participated in credit services than in the other two sectors of Nyamagabe District. In fact, in Kibilizi sector, only 9.6 percent of smallholder farmers accessed credit services while 24.1 percent did not access credit from microfinance institutions. The results show also that 19.6 percent of household have saved their money in formal financial institutions while 14.1 percent were not interested to save in microfinance institutions.

In Gasaka sector, 7.1 percent of household have accessed credit services while 25.4 percent did not access credits from Microfinance institutions. The table shows also that 22.5 percent and 10 percent of households have accessed and do not accessed savings services respectively.

In Tare sector, 8.3 percent of household have accessed credit services while 25.4 percent have not accessed credit. Table 2 shows that 20.8 percent have savings and 12.9 percent did not save their money from microfinance institutions. However, these credit services lead to an increase of smallholder farmers' income and livelihood. Savings services have often been seen as a critical component in improving access to additional investible funds in Nyamagabe District. In this case, smallholder farmers can accumulate money and then draw it for investing in other household assets.

Effects of Microfinance Services on Smallholder Farmers' livelihood in Nyamagabe District
Results of Propensity Score Matching Estimation

The determination of the Average Effect of microfinance services using Kernel-based Matching and Nearest Neighbor Matching involved matching 117 participants in microfinance services and 123 non-participants, and gave an average effect on annual total income of 625,152 Rwandan francs per household (*Equivalent to 735 USD*)

Table 3. Estimates of Propensity Score Matching: Logit Model Dependent Variable: "Participation in Microfinance services" Participatmfs (1/0)

Variables	*Estimates*	*Variables*	*Estimates*
hhgender	-.0753121 (0.823)	hhOccupation	.1907174*** (0.009)
hhAge	.0194483* (0.082)	Distance	-.7411689*** (0.001)
Sizeland	.2790351 (0.386)	Totalassets	7.39e-07 (0.193)
hheducation	.5810336*** **(0.005)**	Percredel	.0546439 (0.877)
hhsize	-.0121269 (0.877)	Off_farm_inc	-.1322959*** (0.008)
hhMaritalst	.1229581 (0.310)	Contant	-1.465257 (0.146)
Number of Obs = 240		Prob > Chi^2 = 0.000	
LR Chi^2 (11) = 66.91		Pseudo- R^2 = 0.2012	
Log likelihood = -132.82727			

Source: Computed by the Author from the field survey data, 2011
Note: * and *** denote significance level at 10% and 1% respectively

The results from Kernel and Nearest Neighbor Matching show that out of 11 variables 5 were significant. The results showed that *household age* is significant at 10 percent, *Household education* is significant at 1 percent level and *household main occupation* is significant at 1 percent. All these variables are hypothesized to have a positive effect on households' likelihood of participating in microfinance services, while "*distance from homestead and off-farm income''* were both significant at 1 percent but influence negatively the smallholders' participation in microfinance services.

Estimation of Average Treatment Effect on Treated (ATT): Effect of microfinance on Smallholder Farmers' livelihood

Table 4 shows the estimates of ATT from the two matching algorithms obtained, using the psmatch 2 command in Stata 14. The outcome variable is "***Total Annual Income***"

The results stated that small farmers' participants in microfinance services have positively increased their total annual income and their livelihood.

Table 4: Estimation of Average Treatment Effect on Treated (ATT)

	ATT using Kernel Based Matching	*ATT using Nearest Neighbor Matching*
Treated	873, 484.991	873,484.991
Control	607,810.496	645,239.176
Difference	**265,674.495**	**228,245.816**
Standard Error	113,983.58	125,549.482
T-Stat	**2.33****	**1.82***

Source: Computed by the Author from the field survey data, 2011
Note: ***, * significant at 1% and 10 % respectively.
Notes: 1USD = 800.79 Rwf : Exchange Rate on 15th February, 2011

Results from the *Kernel Based Matching* showed that the ATT (Average Treatment Effect on the Treated) is equal to 256,674 Rwandan Francs (412 USD). This means that the households participating in microfinance services have increased their total annual income by 412 USD relatives to that of the non-participants. The results show also that the t-statistics for the ATT is equal to 2.33 It was found to be significant at 5 percent level. Results from the *Nearest Neighbor Matching* showed that the ATT is equal to 228,246 Rwandan Francs (366 USD). This means that the households participating in microfinance services have increased their total annual income by 366 USD) relatives to that of the non-participants.

The results show also that the t-statistics for the ATT is equal to 1.82. It was found to be significant at 10 percent. The results from both Kernel and Nearest Neighbor matching show that the households participating in microfinance services have increased their total annual income relatives to that of the non-participants. This implies that there is a positive significant effect on smallholder farmers' income for those participating in microfinance services.

CONCLUSION AND POLICY IMPLICATIONS

Microfinance institutions in Rwanda will be able to compete favorably in the global market and gainfully increase Rwanda economic development. This study analyzed the effect of microfinance on smallholder farmers' livelihoods in Rwanda. The results show also that the variables ''*Age, education, main occupation, distance and Off -farm income* have influenced the probability to access microfinance services in Nyamagabe District. The study revealed that

microfinance have significantly improved the smallholder s' standard of living such as total annual income. In conclusion, the study found out that the smallholder farmers who had participated in microfinance services in Nyamagabe District had increased considerably their annual total income, and it can thus be deduced that the use of microfinance services is one of the best ways to escape poverty in Nyamagabe District and to increase household livelihoods

This study recommends that:

- The government and other stakeholders who are concerned with microfinance as crucial instrument of poverty reduction should take into consideration for better promotion to improve agricultural productivity and small farmers' livelihoods.

- Smallholder farmers should be encouraged to participate in microfinance and SACCOs in order to increase their income.Microfinance Institutions have to be promoted in order to provide an instrument for mobilizing savings and extending credit.Government and financial institutions must work together to support smallholder farmers in enhancing their agricultural productionTo encourage women to participate in microfinance services indeed improves women's decision-making power, particularly over income from their businesses.

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