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Impact of Microfinance Institutions on Household Welfare in Tanzania: Propensity Score Matching Approach

Innocent M. Pantaleo
Lecturer, University of Dar es Salaam
Email:innopanta@yahoo.co.uk

&

Agnes M. Chagama
M.A Student, University of Dar es Salaam
Email:agneschagama06@gmail.com

Abstract
The impact of microfinance on the households' welfare is investigated through comparing clients who had access to financial services through microfinance in Tanzania versus those who did not. Using the Tanzania Finscope Survey (TFS) of 2013 dataset and employing the propensity score matching approach and balancing score model the paper analyses the impact of Microfinance on welfare between borrowers and non-borrowers' households in Tanzania. The empirical results revealed that the average treatment effect of monthly income on the treated was statistically significant among microfinance borrowers implying that borrowers tend to have a higher level of income than non-borrowers. These results imply that there is a need to ensure that operations of microfinance service are sustainable and there is better allocation of the available scarce resources in order to have a greater number of people who have access to financial service that can pull them out of poverty.

Keywords: Microfinance, Poverty, Propensity Score Matching, Tanzania, Borrowers

Introduction

Poverty reduction has been the main goal of many policy initiatives and agendas both globally and regionally (UNDP, 2016). This is because poverty is the number one problem in the world. As indicated in the literature, about three billion people live below US$2 per day (World Bank, 2001), and half a billion people live below US$1 per day; and between 70 to 90 percent of these people live in the developing world and 75 percent of the world

poor are women (World Bank, 2013). In view of this, there have been a number of strategies of fighting poverty and since most of the strategies have been failing, the promotion of access to financial services through microfinance has been considered as a viable alternative. This strategy has resulted into approximately 150 million and above of those in the low income earning bracket succeeding in setting up small business and entrepreneurship activities around the world (McKinney, 2013).

In Tanzania, several initiatives such as Tanzania Development Vision 2025, National Strategy for Growth and Poverty Reduction (MKUKUTA I and II) and Five Year Development Plan I and II as well as CCM Election manifesto have focused on the need of pulling the poor out of poverty trap (URT, 2016; URT, 2012). The limited access to financial services has excluded the poor households from accessing formal bank loans due to lack of collateral to secure the loans. This partly has continued to threaten the achievement of the poverty reduction goals particularly in developing countries (Ghalib *et al*, 2011). According to literature (see for example Adams *et al*, 1984; Braverman and Guasch, 1989; Yaron, 1992; Von Pischke *et al*, 1993; Khandker *et al*, 1995 and Khandker, 1998; Khalily *et al*, 2000; Meyer and Nagarajan, 2000),the failure of development banks and the adverse impact of distortions in rural financial markets have necessitated the emphasis to be placed on the sustainability of microfinance institutions as a way of developing rural financial markets and sustaining credit facilities that can cater for the poor households.

As reported by Brown *et al*, (2015), there is no comprehensive database which records all the microfinance institutions. However, it was noted that about 48 formal financial institutions (MFIs) and 71 NGOs have by December 2011 been providing microfinance services to clients around 690,000, which is almost 10 percent of those in financial systems In Tanzania. The four large dominant MFIs involved in Tanzania are Pride Tanzania, BRAC Tanzania, FINCA Tanzania and Vision Fund (Brown *et al*, 2015). Up to 2015 there were 56 licensed banks and other financial institutions in Tanzania, as opposed to 38 in 2009 and 48 in 2011out of which only 20 were engaged in the deposit-based microfinance operations (World Bank, 2013; URT, 2015).

The rise of Microfinance Institutions in Tanzania reflects a remarkable accomplishment that demonstrates the possibility of providing cost-effective financial services to the poor (Kalu, 2010). Microfinance Institutions are believed to have filled the gap of formal financing failures. These have traditionally been providing the alternatives that fill the void left by formal financing institutions. As informal money lending facilities, microfinance institutions, together with the government support through subsidized lending programs have been involved in eradicating absolute and relative poverty. They have reduced bureaucracy in accessing loan; minimised repayment fee and other costs related loan barriers to enable a great number of people to access loan. They have been using part of their proceeds to support development, screening and monitoring of loans accordingly in order to manage the clients' economic activities and supporting practices of Small and Medium Enterprises (SMEs), individuals, and group enterprises. Despite these efforts, there have been concerns among politicians, practitioners, policy makers, and academicians on the effectiveness of micro financial institutions and micro credit on poverty reduction or welfare improvement (Rathiranee and Semasinghe, 2013). Two arguments have been raised as to whether microfinance institutions help in reducing poverty or improve welfare. One argument is that microfinance institutions do help the poor to be financially included and hence improve incomes and ultimately welfare of the poor. On the other hand, critics argue that the role of microfinance is over stated in poverty reduction and usually replace market forces. Empirically, the evidence has also been contradicting and seem to be varying across regions and localities (Salia, 2014). Therefore, although the role of microfinance institutions on welfare improvement and national development goals is very critical, the evidence on their impact on welfare improvement is yet to be fully explored (Marr and Tubaro, 2011; Triodos Facet, 2011). A review of literature have revealed that there is no single study that has proven beyond doubt how microfinance alleviates poverty (See for example Fotabong and Akanga, 2005; Tilakaratna 2012; Mushtaq and Rauf, 2011; Akosile and Ajayi 2014; Alnaa and Ahiakpor, 2015; Al-Shami *et al*, 2016; Miled and Rejeb, 2015; Salia, 2014; Anyelwisye, 2007; Mang' era, 2013; Kaseva, 2014; Kessy and Urio, 2006).

The reviewed literature has shown that the impacts of microfinance on poverty reduction are contradictory and depend on a place and empirical method used. Also, the studies reviewed within and outside Tanzania do

not employ national representative samples and hence they do not show the average impact of microfinance on poverty reduction at the national level. This is a research gap filled in this paper. Although various studies have used income as a measure of welfare, yet there is no study which captures the short term and medium term effect of microfinance on income in Tanzania. This paper however filled this gap using monthly and annual income to show the short and long term impacts of access to loan on household income. This paper used the national representative Finscope survey dataset and Propensity Score Matching approach to evaluate the impact of microfinance on household welfare using income as a measure of welfare for both short term and medium term. The paper also included asset ownership status to make an impact evaluation among borrowers and non-borrowers. Propensity score matching approach provides a unique opportunity to address sample selection bias on the impact assessment which is likely to affect the results from OLS regressions and normal means comparison tests such as chi-square and t-tests.

This paper therefore assesses the impact of access to microfinance institutions and micro credit on improving welfare particularly income among poor households. Specifically the paper evaluates the differences in specific household characteristics such as consumption, education and health status between households with access to microfinance and those without and assesses the impact of access to microfinance institutions on household welfare. The rest of the paper reviews the existing literature on both theoretical and empirical domains, describes the methodology that was used, presents the results and discussions of the findings obtained from the analysis and lastly it presents the summary of the study, conclusions, and policy implications.

Microfinance and Welfare: Theories

Microfinance services aim at providing financial services to the poor or financially excluded groups. In that way, microfinance improves the welfare of the poor and of the wider community. Two schools of thoughts are considered to explain microfinance effect on household or society welfare. These are welfarist Approach or Approach to social welfare; and Institutionalist approach or the Approach to Financial system. These two approaches differ in the way the poor are helped to gain access to financial services to finance their income generating activities although both share a common goal of increasing household welfare or poverty reduction.

According to Bangoura (2012), the logic of the Welfarist theory or Approach of "Social Welfare" approach is that MFIs are primarily fighting against poverty or are improving social welfare and are not seeking for financial profit through financing poor household's economic activities. They help generate income and employment through providing loans and grants as well as non-financial helps such as training, technical assistance to clients (poor households) and education. This sometimes is referred to as *directed Credit Approach.* This school of thought emphasizes that MFIs are embodied into a social mission and in that case they do not have and should not seek for financial self-sufficiency at any cost because that would deviate from the ideological foundations. Finances of MFIs programs according to this school of thought are not motivated by financial gain, rather they are motivated by the desire to fight against poverty and improve the welfare of the poorer. Therefore, the performance of the MFIs should be based on their impact on the lives of the poor on the basis of after and before joining the MFI program.

On the other hand, institutionalist theory or the Approach to Financial system advocates argues that microfinance Institutions should be profit oriented; that is, they should, in addition to covering operational costs, generate profits to ensure their financial viability and sustainability. The institutionalists believe that making profits and become financial sustainable increases the access of financial services by vast majority of the poor due to an increase in the microfinance movement through its integration into the formal financial system. This school of thought therefore emphasizes on the increase in efficiency and productivity of the MFIs which therefore generate social and economic development in the long run. The evaluation of the impact of microfinance on poverty reduction or welfare improvement bases on this view; particularly it uses profitability as a proxy of assessing success and hence welfare reduction(Bangoura, 2012; Kebere, 2010).

These two points of views do not necessarily oppose each other but rather complement each other. While the primary goal of microfinance is to help the poor at any cost (Welfarist approach) sustainability, viability, and self-reliance are crucial for the long run existence and performance of MFIs and their goals (Institutionalist approach). On evaluating impact of microfinance on welfare, this paper follows the arguments of welfarist theory by

evaluating the impact of access to microfinance on household welfare across different welfare measures.

Methodology

Estimation Method

To achieve the objectives, two empirical methodologies were employed. First the t-test means comparison method was used to assess whether households with access to microfinance institutions and micro credit significantly differ from households without access to microfinance institution. This analysis signifies whether there are potential differences in terms of endowments between borrowers and non-borrowers. And this necessitated the intensive analytical methods to separate microfinance institution effect from other endowment effects on household welfare. In this paper, the two mutually exclusive groups were those with access to microfinance and those without access to microfinance. Then, the t-test assumes the distribution of the outcome variables for the two groups is normally distributed without necessary being independent. Therefore, let Y be the outcome of interest, the test would test whether the means of the variables between the two groups are equal against the alternative, that is, the two means are different. We are to reject null hypothesis that the two means are different if there would be statistical evidence that the means are different. The test was performed using statistical software namely STATA.

Secondly, Propensity Score Matching (PSM) method was used to evaluate the impact of microfinance to poverty alleviation and household welfare. The impact evaluation of program participation ideally involves the search for causality that is to be able to attribute the program participation on the effect of the outcome variable. Though the dataset is not experimental because there was no intentional decision on who are treated and who are not, but the nature of the data can still give a clue and be able to differentiate those with access to microfinance (treated group) and those with no access (as a control group). In other words, we wanted to estimate the addition caused by the treatment or answer the question “what would be the outcome of the treated group if it had not been treated”. In this paper, we assessed the casual effect of the MFIs borrowing or participation on household welfare of the borrowers.

However, households' welfare differences among borrowers and non-borrowers may be by chance and not because they differ in their status in participation into micro credit and microfinance institutions. Yet, micro credit and microfinance were thought as the means of raising incomes among the poor and hence they were considered as a very essential part of financial inclusion and achievement of development desires (Aghion and Morduch, 2005). Though theoretically these institutions have a role to play, careful impact assessment techniques had to be employed to study the direction and magnitude of microfinance institution to welfare of the poor so as not to confuse with systematic differences between these households (Aghion and Morduch, 2005). Many studies have been presenting contradicting evidence on the effect of microfinance to household income of the treated group as opposed to the control group especially when involving observational studies (Ghalib *et al*, 2011).Therefore, to answer the fundamental question of what would be the outcome of the treated if they had not been treated needs the hypothetical or counterfactual characteristics of the outcome observation. Since it is impossible to observe the treated group if they had not been treated at a treatment condition, such a counterfactual has to be carefully selected for comparison. The inappropriate selection of such a counterfactual imposes a selection bias in the estimation of the treatment effect of the program due to the problem of self-select of the individuals into participation and identification because of non-randomization (Austin, 2011; Becker and Ichino, 2002; Grilli and Rampichini, 2011; Itang'ata, 2013).

Participation into MFIs borrowing usually depends on a set of individual characteristics which usually vary across participants and non-participants and hence self-select into the program participation. The use of normal OLS regression method to estimate the impact of program participation would lead to biased estimates (Becker and Ichino, 2002). To counter attack the problems of identification and self-selectivity in programs by different households, impact evaluation methods are considered much superior in assessing the effectiveness of the programs. This paper therefore employed Propensity Score Matching (PSM) method to evaluate the impact of microfinance on welfare of households between borrowers and non-borrowers in Tanzania. The propensity score matching approach involves comparing the treated and the control which have similar observables characteristics using a single score estimate based on these observables

characteristics (Becker and Ichino, 2002; Grilli and Rampichini, 2011; Austin, 2011).

In addition, to find the impact of microfinance programs on households' welfare, we estimated the impact of microfinance participation on household monthly income and different household assets such as ownership of television, radio, connection to piped water and table between participants and non-participants of MFIs borrowing. Ideally, we would like to estimate the Average Treatment Effect (ATE) of the program inclusion. This would be estimated as the difference in the average outcomes between the treated and the control group in the experimental studies (normally RCTs) or the average outcome of the participant before and after treatment. Let Y be outcome of interest, then: $\mathrm{ATE} = \mathrm{E}\left(\mathrm{Y}^1/D=1\right) - \mathrm{E}\left(\mathrm{Y}^1/D=0\right)$.....(1)

Where $\mathrm{Y}^1/D=1$ is the outcome of the treated group, given that it had been treated or outcome after treatment and $\mathrm{Y}^1/D=0$ is the treated group if it had not been treated or outcome before treatment and D is treatment status.

The above equation would measure the difference in the average outcome between the treated group given that it was treated and the treated group given that it had not been treated. However the second component is not observed and thus we always observe the outcome of control group given it was not treated.

Evaluating the impact of the program using observation studies by calculating ATE is impossible because an individual cannot be observed at two different states at the same time. Likewise, the use of program of non-participants as a counterfactual for the participants group leads to a bias because these two groups may have systematic differences which are independent of the treatment. This is usually referred to as selection bias because participants tend to select themselves into the program and hence systematically differ from non-participants. Propensity Score Matching is used to control selection bias through matching treated subjects with their control counterparts based on a set of covariates by calculating a single score referred to as propensity score.

Usually the propensity score is estimated using either logit or probit model based on the assumption underlying the distribution of the data (Ghalib *et al*, 2011; Austin, 2011). These two models lead to the same results in significance and signs as well as comparable coefficients. This study assumes normality of the data and therefore adopted a probit model by Austin (2011) to estimate the matching score or propensity score as:

$$\mathrm{P}\left(D=1/\mathrm{X}=\mathrm{P}\left(\mathrm{Y}^{*}>0/\mathrm{X}\right)=G\left(\mathrm{X}\beta\right)\right)\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots(2)$$

Where G is a standard normal cumulative distribution function that lies between 0 and 1 for all covariates (Ghalib *et al*, 2011) and which is estimated using Maximum Likelihood procedure, X is a vector of covariates while β is a vector of parameters to be estimated. Y^{*} Is a latent variable which influences participation decision and D is a participation decision taking the value of 1 if the household has borrowed from MFI or 0, if it is otherwise. For the propensity score matching to be valid and bias free, a set of assumptions have to be satisfied. These assumptions include Unconfoundedness assumption that states that treatment assignment is independent of the potential outcomes conditional on the observed baseline covariates and Common support or overlapping conditions that states that every subject has a nonzero probability to receive either treatment. It assumes that for a given set of covariates with similar characteristics or values there are both controls and treated groups.

According to Ghalib *et al*, (2011), if the propensity estimation equation(propensity score equation) satisfies the above assumptions, then the PSM estimator of the treatment effect is bias free and is referred to as treatment the effect on treated (ATT). As Austin (2011:70) states "The ATT is the average effect of treatment on those subjects who ultimately received the treatment". The ATT is defined by Austin (2011) as $\mathrm{E}\left(\mathrm{Y}\left(1\right)-\mathrm{Y}\left(0\right)/D=1\right)$. In the context of this study, the PSM estimator of ATT is defined as:

$$\mathrm{ATT}^{\mathrm{PSM}}=\mathrm{E}_{\mathrm{P(X)}/D=1}\left[\mathrm{E}\left(\mathrm{Y}^{1}/D=1,\mathrm{P}\left(1\right)\right)-\mathrm{E}\left(\mathrm{Y}^{0}/D=1,\mathrm{P}\left(0\right)\right)\right]\ldots\ldots\ldots\ldots\ldots\ldots(3)$$

This is bias free if the above assumptions are satisfied. The PSM evaluation method mimic the properties of RCTs in the randomized experiments where the probabilistic of both treated and control are similar (Bellara,

2013). Matching algorithm in observational studies can be a bit complicated since there is not exact one to one match between the treated and the hypothetical counterfactual because the propensity score is a continuous variable. In practice, there are four matching procedures which can be used to calculate ATT based on the calculated propensity score. In this paper, two matching procedures were implemented namely Nearest Neighbour with replacement and Kernel matching approaches. The two procedures were chosen because they are popular in the literature and are easy to implement in the observational studies. For the two matching procedure, the ATT for the outcome of interest is calculated. The significant difference of the ATT is tested using t test comparison method to assess the impact of microfinance institutions on household welfare. The outcome variables include both long term and short term household welfare indicators. The common support region is selected for all matching algorithms so as to ensure that the overlapping conditions are satisfied with however higher risk of losing potential observations.

Variables and Data

Table 1 summarizes the hypothesis or expected signs of different variables. The study used Tanzania Finscope survey data for 2013, which is the national representative dataset on Tanzania. The survey was household based and required one member of household to be interviewed. The sampling design and procedures involved a two-stage cluster scheme where households were selected from the existing list of households of 559 Enumeration Areas (EAs)/villages, out of which 384 EAs were selected in Tanzania mainland and 179 EAs were from Zanzibar. The listing exercise was done to only 15 selected households to capture members of households in all 559 (NBS and FSDT, 2013).

Table 1: Hypothesis of the Variable

The variable	Nature of the variable	Measure of the Variable	Expected sign
Microfinance Participation	Treatment status	Taking 1 if a household participate on financial institution and zero otherwise	NILL
Monthly Income	Outcome variable (welfare component)	Categorical/ordinal for different ranges of income	+
Household assets include bicycle, table, television, piped water, radio, land (more than one acre), hand hoe, livestock and poultry.	Outcome variable (welfare component)	Binary(1 if a household own a particular asset and zero otherwise)	+
Household location	Independent	1=urban, 0 otherwise	+
Age	Independent	Continuous	+
Married Household head	Independent	1=married,0 otherwise	+/-
No spouse	Independent	1=no spouse, 0 otherwise	+/-
Education	Independent	1=educated, 0 otherwise	+/-
Household Size	Independent	Continuous	+
Microfinance Knowledge	Independent	1 if a household seek knowledge, 0 otherwise	+
Gender	Independent	1=male, 0 otherwise	+

Source: Author's Computations

Empirical Results and Discussions

Descriptive Statistics

The general descriptive of the variables employed in the analysis are presented in Appendix 1. In general, a total of 7,987 households were observed but the observation varied across variables because of the

missing observed data in a particular variable. Overall, 87.59 percent of the observed households were male headed household with an average of 36.4 years of age with a minimum of 16 years and maximum of 100 years. These descriptive imply that households are sometimes headed by both young and old people in Tanzania and that are normally economically non active group. On average, the population is active middle aged group and hence economically productive. The access to financial services is not quite easy since over 60 percent rely on public transport with an average of more than one hour to reach any nearest financial service facility. This means that many households incur substantive costs in terms of time and finances to access financial services and thus limited their usage of financial services. In terms of outcome variables- income levels, on average, households earned monthly income of between Tshs. 50,000 and Tshs. 150,000 and the average of between Tshs. 600,000 and Tshs. 1,800,000 annually. The result implies that on average, households are low income earners and this limits their consumption opportunities.

Econometric Results

To fulfil the first objective of this paper, endowment difference among households between borrowers and non-borrowers from MFIs was assessed in order to establish the potential difference between these two groups. A t-test comparison method was first used to show if there was any difference in endowments between borrower and non-borrowers. The results are presented in Appendix 2. The results indicate that borrowers and non-borrowers significantly differ across different endowments. That is, borrowers significantly differed from non-borrowers in many aspects except a few such as access to internet, level of educations, marital status, access to public transports, status of skipping meal and connection to piped water. In all these insignificant differences the possible explanation is that, the cited aspects are universal among households (not unique features) and either necessary to every individual or have constraint to be accessed at higher level by many poor households. Examples of these include access to the internet and piped water which in developing nations such as Tanzania are still a big challenge for almost poor households and particularly those living in the remote or in the periphery.

On the other hand, household characteristics such as age, sex, ownership of different household assets, income levels (categories) and participation in saving groups significantly differ between borrowers and non-borrowers.

The differences in endowment between borrowers and non-borrowers of MFIs have been observed in other empirical works. A study by Awotide *et al,* (2015) found that borrowers and non-borrowers were not entirely similar across different socioeconomic characteristics and thus any impact evaluation method that does not take into account the selection bias will produce misleading results.

Although the differences in endowment between borrowers and non-borrowers exists in the whole sample, when disintegrated according to household residence the differences in endowments are larger between urban dwellers than rural dwellers (See Appendix 3 and Appendix 4). Urban household heads differ in endowment more than rural household heads dwellers which can be attributed to the diversity existing in urban centres compared to limited opportunities in rural areas. Also the differences could imply that urban dwellers have easy access to MFI borrowing which differentiated borrowers and non-borrowers across a diverse livelihoods status.

This difference between borrowers and non-borrowers across residences (urban or rural) can be either because of the participation status in Microfinance Institutions or can be because of the influence of the participation status. This is because the two groups are shown to differ prior to participation in Microfinance institutions. This results gauge the argument that borrowers and non-borrowers are quite different and hence inappropriate impact evaluation methods may present biased results. Either way, impact assessment has to isolate the selection bias which can be a result of the personal selection into participation status. Therefore, PSM approach implements this procedure.

To achieve the second objective PSM strategy was used to match the treated and the non-treated groups with similar observable covariates in order to have a potential counterfactual of the treated and then calculate ATT and test its significance using t test. The validity and quality of this evaluations procedure depends on the calculated propensity score on how it matches the treated and the non-treated subjects. Therefore, several analyses were carried out to ensure that the propensity score satisfy the required property and hence the calculation of ATT is selection bias free. The analysis of propensity score is presented in Table 2.

Table 2: Summary of treatment Effect

	Frequency	Percent	Cum.
Non-borrowers	4,445	87.6	87.6
Borrowers	629	12.4	100
Total	**5,074**	**100**	

Source: Author's Computations

A total of 4,445 non borrowers, which is 87.6 percent of the whole sample, and only 629 borrowers, which makes 12.4 percent of the whole sample were observed. The PSM models matched the treated individuals with the untreated individuals based on the propensity score which was calculated based on the underlying covariates which was thought to affect treatment status. The individual falling in treatment (borrowers) were matched with their untreated counterpart (non-borrowers) which had a similar propensity score or a propensity score in a given range depending on the matching algorithm.

The propensity score in this paper was estimated using a probit model which includes all the covariates which were household specific characteristics and socioeconomic variables which affect the microfinance participation status. The results are shown in Table 3. The results reveal that only two variables had a significant impact on the Microfinance participation status and these were the time taken to the nearest SACCOSS and Participation in a saving group. Participation in a saving group had a positive impact on the participation in the MFIs borrowing which however showed that households which are likely to be participants of saving groups are likely to be borrowers from MFIs. This could be because of the exposure and training received by these households from saving groups which significantly change their altitude towards borrowing and saving as a way of increasing income and household welfare. On the other hand, the greater the distance from the nearest SACCOSS the less the likelihood for the household to be a participant or a borrower in microfinance institutions, which implies that more people would be more likely to borrow from MFIs if they have easy an access to MFIs in terms of location. The results also imply that, the transaction costs or transport costs limit the participation in MFIs which might take out the possible profit from borrowing.

Table 3: Propensity score estimates (Probit model)

Variable	Coeff.	Stand. Error	Z	P>z
Annually Income	-0.1231	0.3301	-0.37	0.709
Monthly Income	-0.7058	0.4064	-1.74	0.082
Meal skipped times	-0.2909	0.9352	-0.31	0.756
Households size	-0.5823	0.6858	-0.85	0.396
Household size squared	0.0444	0.0605	0.73	0.463
Household head age	0.0718	0.1083	0.66	0.507
Household head age squared	-0.0007	0.0011	-0.67	0.502
Access personal phone	-1.2220	2.7848	-0.44	0.661
Access computer	1.0171	1.2101	0.84	0.401
Saving Group participation	2.8559	0.6577	4.34	0
Livestock as a main occupation	0.2796	0.5109	0.55	0.584
Agriculture as source of Income	-0.0602	1.7861	-0.03	0.973
Time taken to the bank	-0.2019	0.4733	-0.43	0.67
Time taken to nearest MFI	0.6242	0.4353	1.43	0.152
Time taken to the nearest SACCOSS	-1.3002	0.5282	-2.46	0.014
Access public transport	0.2421	0.5897	0.41	0.681
Primary education	1.2528	0.8864	1.41	0.158
Post primary Education training	1.5999	1.6576	0.97	0.334
Secondaryeducation	1.1227	0.8670	1.29	0.195
Married household head	2.7464	5.5565	0.49	0.621
Separated household head	3.0285	6.0815	0.5	0.618
Rural	1.0733	1.0094	1.06	0.288
Gender	-0.2747	1.4937	-0.18	0.854

Source: Author's computation

Although many variables are found insignificant, in the estimation of propensity score variables with less influence in the participation status are still included in PSM model because they are deemed to significantly improve the balancing property of the propensity score (Ghalib *et al*, 2011; Austin, 2011) However, for propensity score model to be reasonable, several assumptions or conditions should be met, as discussed earlier in this document, particularly in the methodological section. These include the overlapping or regions of common support, the balancing property and unconfoundness assumption. Although these assumptions are not generally testable, the checking process in the propensity score estimation procedure can be done. The testing was done in this study to ensure the robustness of the estimated propensity score.

The region of common support was selected during propensity score estimation procedure. This involves the deletion of all controls and treated subjects with a propensity score below a minimum limit and above a certain maximum limit during matching algorithm. In this study, the region of common support was [.01537442, .99999553] which means that all subjects below or above this range were not used during matching algorithm. The procedure ensures that the uncofoundedness assumption is satisfied in which both the treated and the control have a probability of being treated and not treated at the same time and hence probability is strictly less than one and greater than zero. Indeed a region of common support satisfies this requirement.

After the region of a common support is selected, blocks of treated and controls were selected and incorporated in the propensity score. A total of 5 blocks were selected and with both controls and treated individuals to be used in the matching algorithm. Table 4 shows the selected blocks. Each block has a range of a propensity score.

Table 4: The blocks of the propensity score for treatment

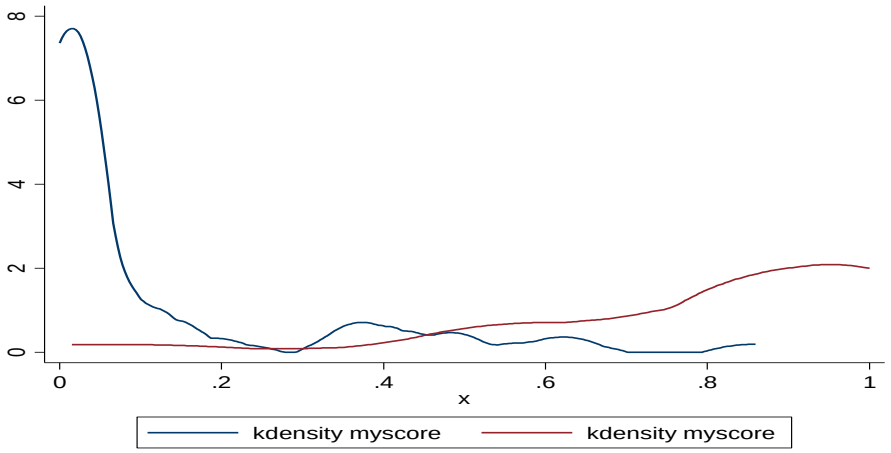
Blocks	Non-borrowers	borrowers	Total
1	21	2	23
2	5	0	5
3	3	3	6
4	2	5	7
5	1	23	24
Total	**32**	**33**	**65**

Source: Author's Computations

Unfortunately, if one of the blocks namely block 2 is found to have no control the use of calliper or radius matching does not give a robust match. Moreover the number of controls and that of treated subjects are not significantly large then the nearest neighbour with replacement gives a better match and hence reduces the bias of the estimates.

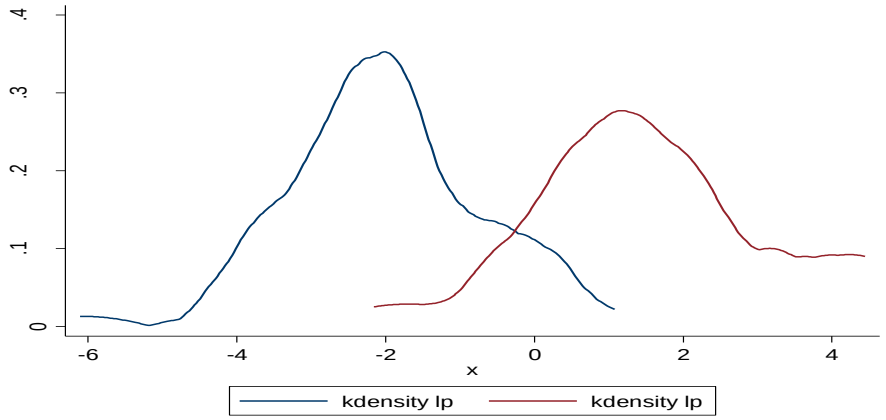
Another diagnostic of a propensity score is the test of balancing property after the matching algorithm. This test ensures that both the controls and the treated are no longer different after the matching procedures in terms of the propensity score based on a set of covariates. The test for the balance property is performed by comparing the means of propensity score as well as endowments across both borrowers and non-borrowers after matching algorithm. This test is incorporated in the propensity score estimation algorithm. The test shows that the balancing property is satisfied. That the households are no longer different in endowments and the average propensity score between borrowers and non-borrowers and hence the average treatment effect on the treated can be estimated with no selection bias. The overlapping condition ensures that both the treated and the controls have an overlap or a common range of a propensity score or its odd rations. The Test for overlapping condition can be performed using a two way propensity score bar graph or kernel density graph. If there is no overlapping of the propensity score between borrowers and non-borrowers then PSM procedure is not good for comparison or impact analysis. The results of these tests are provided in Figure 1.

Figure 1: Kernel density of the estimated propensity score



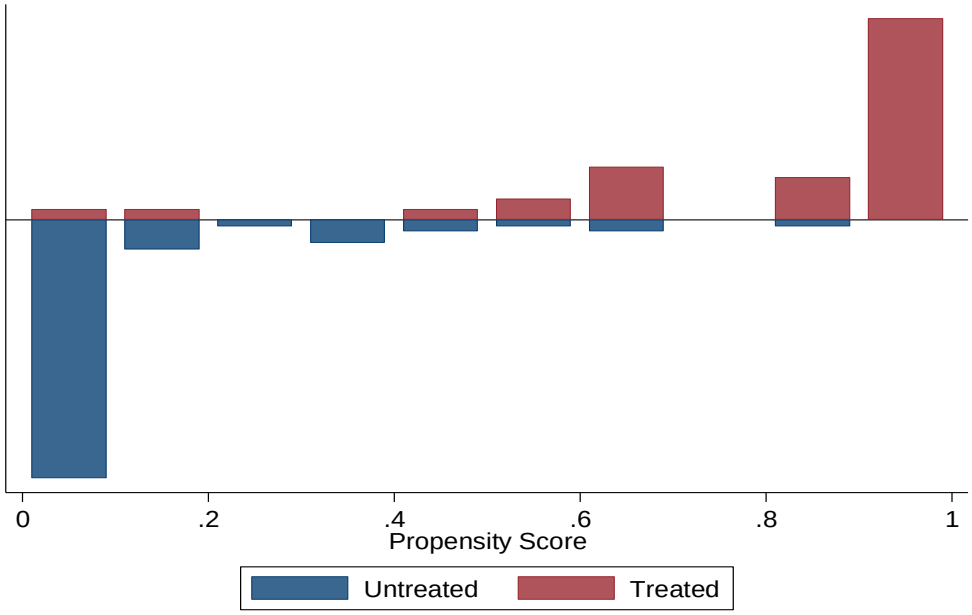
Source: Authors' Computations

Figure 2: Kernel density of logs of odd ratios of estimated propensity score



Source: Authors' Computations

Figure 3: Propensity score graph for both treated and untreated groups



Source: Authors' Computations

All these graphs show that there was overlapping of the propensity score between the treated and the controls. However, overlapping was not so as good. Few members fell in one block while a higher number fell in the other block and some blocks did not have controls. These are common problems in observational studies, especially when there are big differences between controls and treated units prior to treatment. The common procedure is to perform matching with replacement so as to reduce the bias of the mismatch between the treated and the controls units.

The empirical estimations of the average treatment effect on the treated are based on the equation developed in the methodology section.

$$\mathrm{ATT}^{\mathrm{PSM}} = \mathrm{E}_{\mathrm{P(X)}/D=1}\left[\mathrm{E}\left(\mathrm{Y}^{1}/D=1,\mathrm{P}(1)\right)-\mathrm{E}\left(\mathrm{Y}^{0}/D=1,\mathrm{P}(0)\right)\right] \quad \text{.....(4)}$$

However, ATT effect can only be estimated at the population or sample level and not at an individual level. Therefore, the estimated ATT is the effect of treatment on the entire population or effect of moving the population from treated to the untreated. In this paper, a variety of

household welfare indicators were used to assess the impact of microfinance on household welfare. The results are presented in Table 5.

Table 5: ATT for different welfare indicators

	Nearest Neighbour Method		Kernel Method	
Variables	**ATT**	**T test**	**ATT**	**T test**
Piped Water	0.313	1.617	0.224	1.424
Radio	0.313	1.27	0.54	1.552
Television	0.313	1.565	0.242	1.393
Hand Hoe	-0.063	-0.349	-0.024	-1.11
Table	-0.063	-0.335	-0.122	-1.628
Bicycle	0.125	0.334	0.381	1.058
Land(one acre and more)	-0.063	-0.688	-0.142	-1.915
Livestock	-0.25	-0.734	-0.371	-1.484
Poultry	-0.188	-0.791	-0.414	-1.932
Monthly Income	0.813	1.835	0.743	1.630

Source: Author's computation

The results reveal that there was no big difference of ATT across methods particularly in the sign of the effect with little differences in significant and magnitude. Microfinance participation has different effect on different household welfare indicators. However the only statistical significant ATT of microfinance borrowing on household welfare was monthly income which was significant across both methods at 5 percent (significance level). That is, the average monthly income for those individuals who borrowed from microfinance institutions was expected to have a high level of income by 0.813. On the population level, if the whole population borrowed from microfinance the monthly income was expected to be in higher class by 0.813 units. These results indicate that borrowers increase their monthly income due to borrowing and hence are expected to have a better welfare. Microfinance participation has also been found to affect household monthly income. The results are similar to Ghalib *et al*, (2011) who using propensity score matching approach showed that borrowing from microfinance significantly improve household income.

Microfinance borrowing by household was not found to affect other household welfare indicators in this paper even though some had positive

and others negative signs. The results reveal that borrowing from microfinance is not likely to affect household productive asset such as land and hand hoe as well as transport asset such as bicycle and clean water (connection to piped water). The results confirm the results by Salia (2014) who found that productive assets among female borrowers did not seem to be different from non-borrowers. However, these results contradict the finding by Ghalib *et al*, (2011) who found that microfinance borrowing improved ownership of various household assets including piped water connection.

In general, the results show that although microfinance affects households' welfare through increased household incomes, the increased level of income is not directed to owning various household assets and may be household food consumption which was not captured in this study due to data limitations.

Other diagnostic tests were done to find that there is no any serious problem of heteroskedasticity and hence a normal probit model is sufficient to estimate the Microfinance adoption as well as a propensity score matching. Moreover, the insignificant heteroskedasticity test implied that the model fit is correctly specified (Soderbom, 2009). The results for the heteroskedastic model are presented in Appendix 5. Moreover, in this paper, the link test was performed on the probit regression and the results indicate that the model is correctly specified. The results are presented in Appendix 6.

Conclusion

This paper assessed the contribution of microfinance borrowing on household welfare. The paper was motivated by the inconclusive impacts of microfinance on household welfare which seems to depend on locality and empirical models used to assess the impacts of microfinance on household welfare. To respond to its objectives, the paper employed a Propensity Score Matching Approach to assess the impact of borrowing from microfinance institutions on household welfare across a range of household welfare indicators namely household monthly income, ownership of different household assets such as land, radio, television, bicycle, connection to piped water, table, hand hoe, livestock other than poultry and poultry. A balancing score or a propensity score was estimated in which the treated groups (borrowers) were matched with their nearby

counterparts (similar non borrowers) as counterfactuals. The necessary assumptions were examined for the validity of a propensity score including abiding by the region of a common support, balancing of covariates and propensity score after matching and found to be satisfactory. The average treatment effect on the treated was then calculated across various household welfare indicators including monthly income and household assets. However, microfinance participation was only found to significantly affect household monthly income at 5percent level of significance. All others assets were not found in terms of ownership to be significantly different from non-borrowers. The observed results indicate that borrowers increase their monthly income as a results of borrowing but do not diversify household assets ownership. Moreover, the study found that both sexes tend to borrow equally from microfinance institutions and the borrowing is likely from the poor (not poorest) which ultimately improves their level of income. Likewise, access to microfinance is very small (less than 10 percent) in Tanzania which implies that MFIs services are still limited across the country. The results revealed further that access to microfinance was small across the country with disparities between rural and urban dwellers. Therefore, on broader terms, to fulfil the objective of improving households' welfare and poverty alleviation, microfinance should ensure a sustainable service operation and allocate better the available scarce resources. Access will help poor people out of poverty and it would be a way of promoting economic development, employment and growth through the support of micro-entrepreneurs and small businesses. Further studies may use panel data models which can observe both the effects before treatment and effect after the treatment.

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Appendices

Appendix 1: General Descriptive of Key variables in Empirical Models

Variable	Observations	Mean	Standard Deviation.	Min	Max
Outcome Variables(Welfare Indicators)					
Annually Income	2347	18.735	11.838	1	10
Monthly Income	4468	21.571	11.585	1	10
Meal skipped times	7971	25.235	0.6526	1	3
Radio ownership (1=own, 0 otherwise)	7987	0.6653	0.4719	0	1
own land more than 1 acre (1=own)	7987	0.5683	0.4953	0	1
Television own(1=own)	7987	0.1973	0.3980	0	1
Table ownership (1=own)	7987	0.7003	0.4582	0	1
Bicycle ownership(1=own)	7987	0.4456	0.4971	0	1
Hand hoe ownership(1=own)	7987	0.7465	0.4351	0	1
livestock ownership(1=own)	7987	0.3160	0.4649	0	1
poultry ownership(1=own)	7987	0.4837	0.4998	0	1
piped water connection(1=connected)	7987	0.2429	0.4289	0	1
Socio Economic Characteristics					
Household size	7987	49.604	28.802	1	64
household head age	7987	363.686	146.074	16	100
Household Residence(1=urban)	7987	0.3258	0.4687	0	1
Gender(1=Male)	4070	0.8759	0.3297	0	1
MFIs knowledge(1=Have knowledge on MFIs)	7987	0.9050	0.2933	0	1
Access personal phone(1=access)	7987	0.9179	0.2746	0	1
Access to public phone(1=access)	7987	0.0540	0.2260	0	1
Access computer(1=access)	7987	0.0974	0.2965	0	1
Access internet(1=access)	7987	0.1142	0.3181	0	1
saving Group participation(1=participate)	7987	0.1167	0.3211	0	1
Livestock as a main activity (1=Yes)	5750	0.6167	0.4862	0	1
crops farming as a main activity(1=Yes)	5750	0.9643	0.1854	0	1

Variable	Observations	Mean	Standard Deviation.	Min	Max
Main Income Sources					
salary Income(1=Yes)	7987	0.0838	0.2770	0	1
agriculture as a source of Income(1=Yes)	7987	0.5093	0.4999	0	1
Self-employment as a source of Income(1=Yes)	7987	0.3431	0.4748	0	1
Easy access to Financial services					
Time taken to the bank(ordinal)	7560	25.222	0.7233	1	3
Time taken to formal MFIs (ordinal)	7560	30.597	0.9273	1	4
Time taken to SACCOSS	5714	22.219	0.8558	1	3
access to public transport (1=Yes)	7987	0.6140	0.4869	0	1
Education Levels					
Primary education	7987	0.3171	0.4654	0	1
Post primary education training(1=Yes)	7987	0.0058	0.0757	0	1
Secondary education(1=Yes)	7987	0.0884	0.2839	0	1
Post-secondary education training(1=Yes)	7987	0.0126	0.1117	0	1
University Education(1=Yes)	7987	0.0159	0.1251	0	1
Marital Status of the household Head					
Married (1=Married)	7987	0.4441	0.4969	0	1
Separated (1=Not living with a couple)	7987	0.0553	0.2287	0	1

Source: Authors Computations

Appendix 2: T-test Mean comparison between borrower and non-borrower (endowments differences)

	Non borrowers		Borrowers		T test
Variables	**Obs.**	**Mean**	**Obs.**	**Mean**	**(Mean Diff.)**
Outcome Variables (Welfare Indicators)					
Annually Income	1112	1.815	217	2.018	-0.204**
Monthly Income	2310	2.108	409	2.521	-0.413***
Meal skipped times	4433	2.564	627	2.604	-0.04
Radio ownership (1=own, 0 otherwise)	4445	0.654	629	0.752	-0.098***
Own land more than 1acre (1=own)	4445	0.556	629	0.59	-0.034
Television own (1=own)	4445	0.191	629	0.248	-0.057***
Table ownership (1=own)	4445	0.691	629	0.83	-0.139***
Bicycle ownership (1=own)	4445	0.443	629	0.501	-0.057***
Hoe ownership (1=own)	4445	0.736	629	0.797	-0.060***
Livestock ownership (1=own)	4445	0.297	629	0.394	-0.097***
Poultry ownership (1=own)	4445	0.464	629	0.556	-0.092***
Piped water connection (1=connected)	4445	0.26	629	0.248	0.012
Socio Economic Characteristics					
Household size	4445	4.891	629	5.208	-0.317**
household head age	2395	44.886	328	46.29	-1.403*
Household Residence(1=urban)	4445	0.322	629	0.35	-0.028
Gender(1=Male)	2395	0.864	328	0.921	-0.057***
MFIs knowledge(1=Have knowledge on MFIs)	4445	0.995	629	0.895	0.100***
Access personal phone(1=access)	4445	0.908	629	0.978	-0.070***
Access to public phone(1=access)	4445	0.047	629	0.072	-0.024***
Access computer(1=access)	4445	0.094	629	0.116	-0.022*
Access internet(1=access)	4445	0.114	629	0.122	-0.009
Saving Group participation (1=participate)	4445	0.056	629	0.75	-0.694***
Livestock as a main activity (1=Yes)	3144	0.584	475	0.707	-0.123***
Crops farming as a main activity(1=Yes)	3144	0.96	475	0.954	0.007
Main Income Sources					
Salary Income(1=Yes)	4445	0.072	629	0.108	-0.037***
Agriculture as a source of Income (1=Yes)	4445	0.474	629	0.566	-0.092***
Self-employment as a source of Income (1=Yes)	4445	0.302	629	0.607	-0.306***
Easy access to Financial services					
Time taken to the bank (ordinal)	4195	2.543	609	2.491	0.052*

	Non borrowers		Borrowers		T test
Variables	**Obs.**	**Mean**	**Obs.**	**Mean**	**(Mean Diff.)**
Time taken to formal MFIs (ordinal)	4195	3.103	609	2.808	0.295***
Time taken to SACCOSS	3021	2.277	534	2.081	0.197***
Access to public transport (1=Yes)	4445	0.624	629	0.653	-0.029
Education Levels					
Primary education	4445	0.325	629	0.331	-0.006
Post primary education training (1=Yes)	4445	0.006	629	0.006	0
Secondary education (1=Yes)	4445	0.099	629	0.092	0.007
Post-secondary education training (1=Yes)	4445	0.013	629	0.016	-0.002
University Education (1=Yes)	4445	0.018	629	0.024	-0.005
Marital Status of the household Head					
Married (1=Married)	4445	0.466	629	0.474	-0.007
Separated (1=Not living with a couple)	4445	0.061	629	0.043	0.018*

Legends: *****, **, *** shows significant difference at **1%, 5%** and **10%** respectively.
Source: Author's Computations

Appendix 3: T-test mean comparison between borrowers and non-borrowers in urban areas (Endowment differences)

	Non borrowers		Borrowers		T test
Variables	**Obs.**	**Mean**	**Obs.**	**Mean**	**(Mean Diff.)**
Outcome Variables (Welfare Indicators)					
Annually Income	946	1.773	170	1.976	-0.204**
Monthly Income	1377	1.927	245	2.257	-0.330***
Meal skipped times	3007	2.529	408	2.605	-0.076**
Radio ownership (1=own, 0 otherwise)	3014	0,61	409	0.746	-0.136***
Own land more than 1acre (1=own)	3014	0.713	409	0.743	-0,03
Television own (1=own)	3014	0.058	409	0.103	-0.045***
Table ownership (1=own)	3014	0.631	409	0.804	-0.174***
Bicycle ownership (1=own)	3014	0.523	409	0.604	-0.081***
Hoe ownership (1=own)	3014	0.894	409	0.917	-0,023
livestock ownership (1=own)	3014	0.392	409	0.538	-0.146***
Poultry ownership (1=own)	3014	0.583	409	0.694	-0.111***
Piped water connection (1=connected)	3014	0.164	409	0.176	-0,012
Socio Economic Characteristics					
Household size	3014	5.105	409	5.572	-0.467***
Household head age	1558	45.746	200	46.455	-0,709
Household Residence (1=urban)	3014	0	409	0	0
Gender (1=Male)	1558	0.882	200	0.94	-0.058**
MFIs knowledge (1=Have knowledge on MFIs)	3014	0.995	409	0.89	0.105***
Access personal phone (1=access)	3014	0.892	409	0.968	-0.076***
Access to public phone (1=access)	3014	0.017	409	0.027	-0,01
Access computer (1=access)	3014	0.027	409	0.032	-0,005
Access internet (1=access)	3014	0.04	409	0.037	0,004
Saving Group participation (1=participate)	3014	0.059	409	0.8	-0.740***
Livestock as a main activity (1=Yes)	2715	0.603	382	0.746	-0.143***
Crops farming as a main activity (1=Yes)	2715	0.973	382	0.961	0,012
Main Income Sources					
Salary Income (1=Yes)	3014	0.039	409	0.081	-0.041***
Agriculture as a source of Income (1=Yes)	3014	0.628	409	0.736	-0.108***
Self-employment as a source of Income (1=Yes)	3014	0.247	409	0.545	-0.298***
Easy access to Financial services					
Time taken to the bank (ordinal)	2822	2,821	393	2,751	0.071***
Time taken to formal MFIs (ordinal)	2822	3,284	393	3,056	0.228***
Time taken to SACCOSS	2072	2,482	348	2,236	0.246***
Access to public transport (1=Yes)	3014	0.525	409	0.567	-0,042

	Non borrowers		Borrowers		T test
Variables	**Obs.**	**Mean**	**Obs.**	**Mean**	**(Mean Diff.)**
Education Levels					
Primary education	3014	0.341	409	0.333	0,009
Post primary education training (1=Yes)	3014	0.005	409	0.007	-0,002
Secondary education (1=Yes)	3014	0.062	409	0.059	0,003
Post-secondary education training (1=Yes)	3014	0.008	409	0.015	-0,007
University Education (1=Yes)	3014	0.006	409	0.012	-0,007
Marital Status of the household Head					
Married (1=Married)	3014	0.454	409	0.452	0,002
Separated (1=Not living with a couple)	3014	0.057	409	0.032	0.025**

Source: Authors Computations

Appendix 4: T-test mean comparison between borrowers and non-borrowers in rural areas (Endowment differences)

Variables	Non borrowers		Borrowers		T test
	Obs.	Mean	Obs.	Mean	(Mean Diff.)
Outcome Variables (Welfare Indicators)					
Annually Income	166	2.054	47	2.17	-0,116
Monthly Income	933	2.375	164	2.915	-0.540***
Meal skipped times	1426	2.638	219	2.603	0,035
Radio ownership (1=own, 0 otherwise)	1431	0.746	220	0.764	-0,018
Own land more than 1acre (1=own)	1431	0.224	220	0.305	-0.080***
Television own (1=own)	1431	0.472	220	0.518	-0,046
Table ownership (1=own)	1431	0.818	220	0.877	-0.060**
Bicycle ownership (1=own)	1431	0.276	220	0.309	-0,033
Hoe ownership (1=own)	1431	0.404	220	0.573	-0.169***
Livestock ownership (1=own)	1431	0.098	220	0.127	-0,029
Poultry ownership (1=own)	1431	0.213	220	0.3	-0.087***
Piped water connection (1=connected)	1431	0.461	220	0.382	0.079**
Socio Economic Characteristics					
Household size	1431	4.441	220	4.532	-0,091
Household head age	837	43.287	128	46.031	-2.745**
Household Residence(1=urban)	1431	1	220	1	0
Gender(1=Male)	837	0.83	128	0.891	-0.060*
MFIs knowledge(1=Have knowledge on MFIs)	1431	0.994	220	0.905	0.090***
Access personal phone(1=access)	1431	0.941	220	0.995	-0.055***
Access to public phone(1=access)	1431	0.111	220	0.155	-0.043*
Access computer(1=access)	1431	0.235	220	0.273	-0,038
Access internet(1=access)	1431	0.268	220	0.282	-0,013
Saving Group participation(1=participate)	1431	0.05	220	0.659	-0.609***
Livestock as a main activity (1=Yes)	429	0.464	93	0.548	-0,085
Crops farming as a main activity(1=Yes)	429	0.879	93	0.925	-0,046

Variables	Non borrowers		Borrowers		T test
	Obs.	Mean	Obs.	Mean	(Mean Diff.)
Main Income Sources					
Salary Income(1=Yes)	1431	0.139	220	0.159	-0,02
Agriculture as a source of income(1=Yes)	1431	0.15	220	0.25	-0.100***
Self-employment as a source of Income(1=Yes)	1431	0.416	220	0.723	-0.306***
Easy access to Financial services					
Time taken to the bank(ordinal)	1373	1.97	216	2.019	-0,048
Time taken to formal MFIs(ordinal)	1373	2.731	216	2.356	0.375***
Time taken to SACCOSS	949	1.831	186	1.79	0,041
Access to public transport(1=Yes)	1431	0.832	220	0.814	0,019
Education Levels					
Primary education	1431	0.29	220	0.327	-0,037
Post primary education training(1=Yes)	1431	0.008	220	0.005	0,004
Secondary education(1=Yes)	1431	0.177	220	0.155	0,023
Post-secondary education training(1=Yes)	1431	0.026	220	0.018	0,008
University Education(1=Yes)	1431	0.045	220	0.045	0
Marital Status of the household Head					
Married(1=Married)	1431	0.492	220	0.514	-0,022
Separated(1=Not living with a couple)	1431	0.07	220	0.064	0,006

Source: Authors Computations

Appendix 5: Heteroskedastic probit model

Number of observations	**1796**		
	Zero outcomes		**1530**
	Nonzero outcomes		**266**
	Wald chi2 (27)		**3.47**
Log likelihood = -378.5051	**Prob > chi2**		1

Independent Variable	**Coeff.**	**Stand. Error**	**z**	**P>z**
Saving Group participation status	3.2377	2.0876	1.5500	0.1210
Access internet	-0.0072	0.3774	-0.0200	0.9850
Access computer	0.0208	0.4111	0.0500	0.9600
Access public phone	0.5204	0.5086	1.0200	0.3060
Access personal phone	0.6266	0.6196	1.0100	0.3120
MFI knowledge	-2.0826	1.4814	-1.4100	0.1600
Salary Income	0.5901	0.5488	1.0800	0.2820
Agriculture Income	0.5785	0.4138	1.4000	0.1620
Self-employment Income	0.9359	0.6240	1.5000	0.1340
Gender	-0.0116	0.3877	-0.0300	0.9760
Rural	0.2195	0.2632	0.8300	0.4040
Highest education level	0.1515	0.1174	1.2900	0.1970
Primary education	-0.9217	0.7020	-1.3100	0.1890
Post primary training	-1.4385	1.0695	-1.3400	0.1790
Secondary education	-1.8483	1.3707	-1.3500	0.1780
Post-secondary training	-0.8282	0.9073	-0.9100	0.3610
University education	-1.5953	1.3029	-1.2200	0.2210
Married	0.0620	0.6330	0.1000	0.9220
Separated	-0.1673	0.6608	-0.2500	0.8000
Household size	0.0063	0.0593	0.1100	0.9150
Household size squared	-0.0001	0.0027	-0.0400	0.9670
Household head age	0.0489	0.0474	1.0300	0.3020
Household head age squared	-0.0005	0.0005	-0.9800	0.3290
Time taken to the bank	0.3909	0.3020	1.2900	0.1950
Time taken to Pride, FINCA, etc.	-0.1379	0.1699	-0.8100	0.4170
Time taken SACCOSS	-0.1475	0.1773	-0.8300	0.4050
Public transport	0.0909	0.2213	0.4100	0.6810
Constant	-3.3219	2.2085	-1.5000	0.1330

Independent Variable	Coeff.	Stand. Error	z	P>z
Primary education	0.2452	0.1584	1.5500	0.1220
Post primary training	-12.1891	102.0905	-0.1200	0.9050
Secondary education	0.3880	0.1969	1.9700	0.0490
Post-secondary training	0.1131	0.3398	0.3300	0.7390
University education	0.2151	0.2702	0.8000	0.4260
Married	0.4218	0.5500	0.7700	0.4430
Separated	0.4866	0.5766	0.8400	0.3990
Household size	-0.0072	0.0175	-0.4100	0.6830
Household head age	-0.0003	0.0039	-0.0800	0.9350
Time taken to the bank	0.0841	0.0815	1.0300	0.3020
Time taken to MFI.	-0.0536	0.0669	-0.8000	0.4230
Time taken SACCOSS	-0.1152	0.0644	-1.7900	0.0740
Public transport	-0.0010	0.1104	-0.0100	0.9930

Likelihood-ratio test of lnsigma2=0: chi2 (13) = 20.28 Prob > chi2 = 0.0884

Appendix 6

Test for model specification, link test.

Probit regression **Number of observations 1283**
LR chi2 (2) 577.42
Prob> chi2 0

Log likelihood = -271.58981 **Pseudo R2 0.5153**

MFI status	Coeff.	Stand. Errors	z	P>z	[95% Conf. Interval]	
_hat	0.9783789	0.087141	11.23	0	0.8075848	1.149173
_hatsq	-0.017668	0.058251	-0.3	0.762	-0.1318387	0.0965027
_cons	0.0173372	0.090534	0.19	0.848	-0.1601055	0.1947799