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Impact of Village Community Banks on Household Investment: Quasi-experimental Evaluation from Kilosa District, Tanzania

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Abstract: Village Community Banks (VICOBA) is a type of microfinance model organized by community members that provide savings and credit services to low-income households in Tanzania. VICOBAs have shown to be effective in increasing household savings and reducing poverty. Objective of this paper was to examine the impact of VICOBA membership on investment decisions of the household, as there is limited research of its impact on household investment. This paper examined the impact using a survey of randomly selected sample of 99 VICOBA members and 203 non-members in Kilosa District, Tanzania. Impact is estimated using Propensity Score Matching (PSM) and Endogenous Switching Regression (ESR). The PSM results showed that VICOBA membership had positive significant results on investment, showing an average of TZS 274605.65 which is 140.5 percent increase in investment for members' households compared to their counterfactual, from average investment of TZS 195,407.3. The ESR confirms the results after controlling for both observed and unobserved covariates. The findings concluded that VICOBA members are more likely to invest in income generating activities than non-members. Therefore, it was suggested that the model can play a role in promoting household investment and economic uplift, financial inclusion and poverty reduction in Tanzania. The government of Tanzania should support the development of VICOBAs to a sustainable manner and have legal and regulatory framework to help LGAs monitor, regulate and integrate these groups into development plans.

Keywords: *Village Community Banks, Household Investment, Propensity Score Matching, Endogenous Switching Regression*

1.1 Study Background

Access to financial services and transformation of such services into growth and development has popularity with big businesses operating in large towns and cities across the world. However, the case has been different when it turnout to rural, remote and considerable poor communities where access of financial institutions has been regional and definitely global challenge that requires something else be

done, hence has pushed the need for microfinance schemes as a remedy to financial inclusion (Menza & Kebede, 2016).

With the difficulties of accessing financial services through financial institutions, microfinance model, which is a financial service that provides access to credit, savings, and other financial products to low-income individuals and households, had developed to address the issue over that period. The early idea was that of cooperative bank (i.e., Raiffeisen Bank) formed in Germany in 1864 so as to launch and spread the awareness of "self-help" in rural communities through offering savings and microcredit services, but the Bangladesh experience ; famous known "the Bangladesh Grameen bank" established by social entrepreneur, banker and economist Professor Muhammad Yunus in 1976 is more relevant to Village Community Banks (VICOBA) and operates worldwide as it is named in Asia as Self Help Groups (SHG) (Mashigo & Kabir, 2016; Ngalemwa, 2013).

In Africa such microfinance model became famous from early 1990s pioneered by Cooperative for Assistance and Relief Everywhere shortened as CARE International in Niger where it was proved to be more successful and operative lending model, then to the rest, definitely East Africa in West Nile Uganda and Zanzibar through CARE Tanzania in year 2000, but operates under different titles, for example it is named JENGA (Joint Encouragement of Gainful Activities) in Uganda and JOSACA (Jozani Saving and Credit Association) in Zanzibar (Ngalemwa, 2013; Bakari et al.,2014). In Tanzania, VICOBA was adopted and reformed by Social and Economic Development Initiatives of Tanzania (SEDIT) and registered as Village Community Banks, abbreviated as VICOBA (Bakari et al., 2014)

According to SEDIT (2021), VICOBA is a participatory grass root financial development model operating through self-selected groups of people ranging from 25-30 members who are then divided into smaller groups of fives called collateral groups. Members elect management committee; all members are trained on business management, entrepreneurship and group management on their weekly meetings. The banking operation starts by pre determining share value, of which can be TZS. 1000, 3000, 5000, or else, each member has to buy at least 1 up to some agreed amount of share per week plus groups predetermined education, health and operational funds. By 2021, SEDIT had over 4,000 groups with over 100,000 members in 40 districts; group capital amounting to over Tsh.50 billion whereas Kilosa is one the districts where VICOBA operate at large with about 203 registered groups having 4,300 members before the study (SEDIT, 2021; Kilosa District Council, 2021).

Despite its potential, there are varying views about the impact of these informal groups, for example, Okatch *et al.* (2018) notes that the existence of the informal services highlights the general demand for financial services such as saving and lending, but the services are not adequate to grab economic opportunities like lending for income generation activities the full. De Wet et al., (2012) indicates that micro-savings look more promising than that on microcredit, but savings do not appear to increase income and that there is less evidence of its efficiency. On the other hand Kihongo (2005), Ngalemwa (2013), Massawe (2020) and Dyanka (2020) on assessing the contribution of VICOBA in Tanzania; show that there is positive contribution on the capacity building achieved through provision of trainings, improved livelihoods, social cohesion, and empowerment of its members, yet there is problem of income generation to the participants. This paper focuses to uncover whether VICOBA is worth undertaking for participants' investment which is vital for economic fortune of the households and a country, and Kilosa district provides good representation as it is one of the areas with VICOBA concentration.

1.2 Statement of the Problem

Though access to financial services to the mass has been troubling in Tanzania, VICOBA has been considered as a decorous and active way of catalyzing development initiatives and financial inclusion for the local and low income that can't access financial institutions. Recent FinScope survey shows that there is significant growth in the share of informal saving groups of about 16% (4.4 million people) of the adults in 2017 from 12% in 2013 unlike formal saving groups (SACCOs) whose share of the total adults was 2% in 2017 compared to its 3% of 2013 in Tanzania, and that 73% of those in informal saving groups are found in members' self-established saving groups (FinScope Tanzania, 2017). This means informal, self-established saving groups led by VICOBA are significant in microfinance subsector in the country. To this point, many studies have been conducted on the economic and social effects of VICOBA and have shown positive results according to participants' expectations, therefore opt as their aid for sustaining their livelihood and solving some financial problems within their families. But investment into income generating activities out of the groups has remained poor and is not clearly scanned and lack empirical analysis; this means lack of financial sustainability. Also, no established evidence whether the celebrated impacts are surely resulted from VICOBA program and not otherwise. So, this paper aims to examine the impact of VICOBA on households' investment empirically using propensity score matching and endogenous switching regression.

1.3 Research Objective and hypotheses

Objective of this research paper was to examine the impact of Village Community Banks membership on investment decisions of the household in Kilosa district. It was about addressing specific research questions; to what extent does VICOBA membership impact on household investments? What is the direction and magnitude of the impact? The null hypothesis to be tested; H_0: Investment of the members' households does not differ significantly from those who are non-members of VICOBA. The alternative hypothesis: H_1: Investment of the members' households differs significantly from those who are non-members of VICOBA, meaning that members have higher level of investment compared to non-members.

The study expects that if VICOBA membership has significant impacts on investment of the household, then null hypothesis will be rejected in favor of an alternative hypothesis, and vice versa. The findings will be valuable for policymakers and practitioners who are interested in promoting household investments and financial inclusion in Tanzania.

1.4 Literature review

1.4.1 Theoretical framework

To study how VICOBA can help to impact the investment behavior of households in Tanzania, this paper applies classic microfinance theory of change as the framework. Classic microfinance theory of change is a specific type of microfinance theory of change that was developed in the mid-1990s. Classic microfinance theory of change states that microfinance can help to reduce poverty by providing access to credit to low-income individuals and households. The theory mentions three vital steps that a person must follow to make it true which are; take a loan from (or save with) a microfinance institution (or similar entity), invest the money in a workable business and manage the business to yield major

return on the investment (Dunford, 2012). So microfinance provides means for low-income people to save with, or access credit, and use that saving or loan to invest in income generating activities.

In the context of VICOBA, this theory suggests that individuals who participate in VICOBA will save more or have access to much credit than those who do not participate. It provides saving services and access to credit, additional income from distribution of shares and profits, and financial education, which can help individuals to add to their average income and manage their money more effectively. As a result, individuals who participate in VICOBA are likely to have higher levels of investment than the counterfactual.

1.4.2 Empirical review

Ngalemwa (2013) conducted a study on the contribution of VICOBA to income poverty alleviation in Rufiji Delta, Tanzania. The study used a cross-sectional design and primary data was used in analysis to determine means, frequencies and percentages. An OLS regression analysis was done and used t-test to define variation between groups. It was found that VICOBA can help to reduce poverty by providing access to credit and by helping people to save money. Kihongo (2005), Rutenge (2016), Massawe (2020), and Dyanka (2020) conducted studies on the impact of VICOBA in Tanzania. These studies used similar study designs and methodologies and praised VICOBA practices to have positive implications on household welfare, including increased income and investment in income generating activities. The descriptive survey done by Okatch et al (2018) on studying practice of table banking and its economic empowerment on women in On'gata Rongai, Kajiado, Kenya using both qualitative and quantitative data collection methods found that it has benefits and economically empowers women as it provided women with a reliable means of access to financing due to its convenience it offers.

Issahaku (2011) conducted studies on the determinants of saving and investment in Ghana. The study applied linear saving and investment functions in estimating the determinants by developing separate regression models respectively for the determinants of saving and investment behavior, both of them had viable descriptive and econometric results in explaining the phenomena studied. In Morocco, Crépon et al, (2011) applied randomized control trial (RCT) to examine impact of microcredit in rural areas and had found that microfinance generated significant increase in investment on assets especially for agricultural activities and self-employment associated with a substantial increase in profits. Farida et al., (2016) conducted a cross-sectional study on the impact of credit program to micro-entrepreneurs in Indonesia using propensity score matching and found no significant impact, but has positive trend in improving working capital, sales, saving and domicile conditions of micro entrepreneurs.

The review concludes that more research is needed to understand the inconclusive impact of microfinance programmes on household investments. This paper contributes to this body of research by using a quasi-experimental design to estimate the impact of VICOBA on household investments in Tanzania empirically by employing propensity score matching (PSM) and then apply Endogenous Switching Regression (ESR) technique as a robust for consistent results.

1.5 Methodology

Study area, population and sampling

The study was conducted in Kilosa District, Morogoro region inTanzania, which is located at latitude 6^0 50′ 0″S and longitude 36^0 59′ 0″E with a population of 511,130, having more than 200 registered

VICOBA groups with about 4,300 members (Kilosa District Council, 2020). The study population was VICOBA participants and non-members. Stratified sampling was used to obtain 8 representative wards and groups to cover their distribution over the district. Simple random sampling was used at the final stage to obtain 305 respondents from both treatment and control groups. After cleaning, 302 observations were used for analysis. Sample size was obtained by the following formula;

$$N= \frac{(Z_{\alpha/2})^2 * P*(1-P)*D}{E^2}$$

N = total sample size, $Z_{\alpha/2}$= corresponding value for set level of confidence (this study used 95%), $Z_{\alpha/2}$=1.96, P=proportion of event of interest for the study; P=0.008 i.e. (4,300/511,130); E=margin of error =0.01; and D=designed effect which is 1 for simple random sampling;

$$\mathrm{N} = \frac{[1.96^2 \ * 0.008 * (1 - 0.008) * 1]}{0.01^2} = 304.9 \ \approx \ \mathbf{305}$$

Then to obtain sample of treatment (n1) and control (n2) for the effective matching, most literatures suggest ratio of 1:2, so for this case n1= 102 and n2= 203.

Research Design

Cross sectional design was adopted in collecting data from the treatment group (VICOBA members) and control group (Non-members). This study is quantitative in nature as it examines the variables while including numbers as well as statistics to analyze the findings. The study adopted the Quasi-experiment impact evaluation with Propensity Score Matching (PSM) and Endogenous Switching Regression (ESR) methods to get the average treatment effect on treat to capture impact of VICOBA membership. The motive of using PSM is the characteristics of the data which is cross-sectional and matching the two groups. However, for robustness of the results, ESR was used as it helps to control for unobservable which is the shortfall of PSM.

Model Specification

To have the impact of VICOBA on investment, it is first assumed that household is rational to membership; the utility gain from membership $(M^* = M_1 - M_0)$ is conveyed as a function of observable characteristics (X) in a probit model as:

$$\boldsymbol{M_i^* = \theta + \beta X_i} + \ldots + \mu_i \quad , \boldsymbol{M_i = 1 \ if \ M_i^* > 0} \qquad \textbf{(3.1)}$$

Such that

$$P\,(M_i = 1|X_i) = f(\boldsymbol{\theta + \beta_1 X_{i1}} + \ldots + \boldsymbol{\beta_n X_{in}})$$

$\boldsymbol{M}$ is a binary variable; = 1 if household representative $\boldsymbol{i}$ is VICOBA member and = 0 if non-member, $f(.)$ is a cumulative standard normal distribution function, β=coefficients to be estimated and X_i is a vector of covariates; and μ_i = error term assumed to be normally distributed.

Regression equation for outcome:

$$\boldsymbol{Y_i = \alpha + \delta M_i + \beta X_i} + \ldots + \boldsymbol{\varepsilon_i} \qquad \textbf{(3.2)}$$

$\mathbf{Y_i}$ =outcome variable (**investment**) for observation $\boldsymbol{i}$, $\boldsymbol{M}$ = membership dummy variable (= 1 if VICOBA member, 0 if not), $\boldsymbol{X_i}$=household characteristics, $\boldsymbol{\alpha}$ is a constant**,** $\boldsymbol{\delta}$ = effect of VICOBA (main parameter of interest), $\boldsymbol{\beta}$ =coefficients to be estimated and $\boldsymbol{\varepsilon}$ is an error term.

Covariates description for household i

X_1= Age (in years);
X_2= Gender; (Dummy; 1=male, 0 =female)
X_3= Marital status, (Dummy;1=married, 0=otherwise)
X_4= Dependents (Number of dependents for the household i)
X_5= Financial training; (Dummy; 1=acquired training, 0=not)
X_6= Education; (Level of education in number of years of schooling)
X_7= Employment; (Dummy; 1=Salaried employment, 0=otherwise)
X_8= Microcredit; (Dummy; 1=if obtained microcredit other than VICOBA, 0=not)
X_9= Working experience (in years).

Econometric Model Estimation

Propensity Score Matching (PSM)

Probit regression was used for obtaining propensity scores on membership to enable matching the observations and then estimates the impact by nearest neighborhood.

Uncofoundedness is the central assumption to be met first as Duvendack (2010) shows that;

$$Y^0, Y^1 \perp\!\!\!\perp M | X \ (Unconfoundedness) \qquad (3.3)$$

Where $\perp\!\!\!\perp$ represents independence, if this holds, it follows that

$$E(Y^0|X, M = 1) = E(Y^0|X, M = 0) = E(Y^0|X) \qquad (3.4)$$

and

$$E(Y^1|X, M = 1) = E(Y^1|X, M = 0) = E(Y^1|X) \qquad (3.5)$$

Which means the outcomes of VICOBA non-members would have the same distribution as the outcomes of members had they not participated given conditionality on X.

Also, the assumption of common support (overlap) has to be met and applies to all X

$$0 < Pr\,(M = 1|X) < 1 \quad (Overlap) \qquad (3.6)$$

However, in a particular case, it is adequate to assume

$Y^0 \perp\!\!\!\perp M | X$ and $P\,(M = 1|X) < 1$ and hereafter ATT be obtained as follows

$$\boldsymbol{\Delta ATT = E(Y^1|X, M = 1) - E_X[E(Y^0|X, M = 0)|\, M = 1]} \qquad \mathbf{(3.7)}$$

Where $\boldsymbol{E(Y^1|X, M = 1)}$ is the mean outcomes of treated individuals and $\boldsymbol{E_X[E(Y^0|X, M = 0)|\, M = 1]}$ is the calculation of the matched control individuals (Duvendack, 2010).

Endogenous Switching Regression (ESR);

The first step is decision to join VICOBA, equation (3.1), and then it follows the two regime outcome equations:

Regime 1: $\boldsymbol{Y_{1i}} = \boldsymbol{\alpha_1 x_i} + \ldots + \mu_{1i}$ if $M = 1$ (members) (3.8)

Regime 2: $\boldsymbol{Y_{2i}} = \boldsymbol{\gamma_2 x_i} + \ldots + \boldsymbol{\varepsilon_{2i}}$ if $M = 0$ (non − members) (3.9)

$\boldsymbol{x_i}$ =household characteristics, $\boldsymbol{Y_1}$ and $\boldsymbol{Y_2}$ represent **investment** for VICOBA members $(\boldsymbol{Y_1})$ and non-members $(\boldsymbol{Y_2})$, μ and $\boldsymbol{\varepsilon}$ are Error terms, $\boldsymbol{\alpha}$ and $\boldsymbol{\gamma}$ are the parameters to be estimated.

Then; average treatment effect on treated (ATT) and average treatment effect on untreated (ATU);

$$\boldsymbol{ATT = E\,[Y_{1i} \mid M = 1] - E\,[Y_{2i} \mid M = 1]} \quad (3.10)$$

$$\boldsymbol{ATU = E\,[Y_{1i} \mid M = 0] - E\,[Y_{2i} \mid M = 0]} \quad (3.11)$$

Where;

$\boldsymbol{E\,[Y_{1i} \mid M = 1]}$ =expected outcome of members with membership of VICOBA (real)
$\boldsymbol{E\,[Y_{2i} \mid M = 1]}$ = expected outcome of members if they had no membership (counterfactual)
$\boldsymbol{E\,[Y_{1i} \mid M = 0]}$ = expected outcome of non-members if had membership (counterfactual)
$\boldsymbol{E\,[Y_{2i} \mid M = 0]}$ = expected outcome of non-members without membership of VICOBA (real).

Data Sources, Collection, Analysis and Presentation

Primary data was collected through a structured questionnaire administered to a treatment and control groups of respondents. STATA (Version 15) statistical software was used for analysis where before econometric results; diagnostic tests were carried out to ensure the trustworthiness and legitimacy of the results. Presentation is clear through graphs, tables, figures and statements.

1.6 Study Findings and Discussion

Descriptive Statistics

A total of 302 households were surveyed, 99 in the treatment group and 203 in the control group. The majority of the respondents (78.81%) were female; respondents' average age was 43.95 years. Nearly three-quarters of the respondents (75.83%) were married and had an average of 3 dependents per household. Only 12.25% of the respondents had salaried employment, while the majority (60.6%) relied on self-employment in crop cultivation and 17.88% on livestock keeping. The average working experience was 20 years, with a maximum of 55 years. These results are in line with national statistics that 79 percent of Kilosa district's employment positions are within agriculture (NBS, 2013), This suggests that people's livelihoods are largely dependent on agriculture and are likely to be affected by seasonal fluctuations in income.

Table 1: Employment status of the respondents

Employment category	VICOBA Membership				Total	
	Non-members		Members			
	N	%	N	%	N	%
Crop Farming	131	64.53	52	52.53	183	60.60
Livestock keeping	31	15.27	23	23.23	54	17.88
Salaried employment-in government	19	9.36	6	6.06	25	8.28
Salaried employment-private sector	6	2.96	6	6.06	12	3.97
Self-employed	11	5.42	9	9.09	20	6.62
Casual labourer	5	2.46	3	3.03	8	2.65
Total	**203**	**100**	**99**	**100**	**302**	**100**

Source: Author's Computations of field data, 2023

On average, respondents had an education level equivalent of Standard III. The highest level of education attained was a diploma. This suggests that the education level in the study area was generally low. About 33.44% of respondents had no formal education, while 47% had attended primary school from Standard IV to Standard VII. The remaining 20% had attended secondary school from Form II to Ordinary Diploma level. The low level of education among the respondents is likely to be a barrier to employment and economic advancement.

Table 2: Educational status of the respondents

Education level	VICOBA Membership				Total	
	Non-members		Members			
	N	%	n	%	N	%
No education	67	33.00	34	34.34	101	33.44
Standard four	5	2.46	2	2.02	7	2.32
Standard seven	90	44.33	45	45.45	135	44.70
Form two	9	4.43	2	2.02	11	3.64
Form three	0	0.00	1	1.01	1	0.33
Form four	16	7.88	8	8.08	24	7.95
Form four (+training)	12	5.91	6	6.06	18	5.96
Ordinary diploma	4	1.97	1	1.01	5	1.66
Total	**203**	**100**	**99**	**100**	**302**	**100**

Source: Author's Computations of field data, 2023

The 75.5% of households in the study area do not use or have bank accounts and rely on public transportation to reach banks, with an average of 31 kilometers away. This makes it difficult and expensive for these households to access financial services. However, 25.5% of households that have bank accounts is higher than the national average of 12.3%, but lower than the maximum average of 31.3% (National Council for Financial Inclusion, 2018; NBS, 2019). On the other hand only 17.88% of households in the study area have received financial literacy training. The lack of access to financial

services and financial literacy is a barrier to economic development as it makes it difficult for households to save money, invests in their businesses, and protects themselves from financial risks.

In relation to VICOBA banking operations, members had an average share value of TZS 6040, the minimum share value bought was TZS 1,000 and the maximum was TZS 15,000 per week per member. This means on average a person saves TZS 24,160 with VICOBA per month. A mean value of loan provided was TZS 112,626.3 where maximum loan from VICOBA obtained was TZS. 600,000. Appendix table 3 presents summary statistics of VICOBA banking. In terms of outcome variable; on average investment was TZS 195,407.3 where the average investment for VICOBA members was TZS 355,000 and Non-members was TZS 117,576.4. These were for any month that the households were asked if they invested money in income generating activity. These results indicate that household investment is in favor of VICOBA members compared to non-members and that non-members are below average; therefore, reflect that on average the households are not financially secured without an alternative to save or access credit. General descriptive are shown in appendix table 1.

Econometric Results

Test for Multicollinearity:

Multicollinearity exists when there is a correlation or linear relationship between multiple independent variables in a regression, making it difficult to isolate the effect of any one variable on the dependent variable. According to Wooldridge, (2018) there is no cutoff value for VIF above which we can make a conclusion that multicollinearity is a problem, but if VIF_i value is above 10, we can conclude that multicollinearity is a problem for estimating coefficients. The test carried out by using variance inflation factor (VIF) to recognize severity of multicollinearity portrayed that VIF values are 1.88 and below, and the mean VIF was 1.31 inferring that there is no serious multicollinearity that requires further investigation or any correction.

Table 3: Test Results for Multicollinearity

Variable	VIF	1/VIF
Age	1.84	0.543971
Gender	1.04	0.957637
Marital status	1.07	0.935348
Dependents	1.05	0.950719
Training	1.04	0.961910
Education	1.48	0.675070
Employment	1.31	0.760631
Microcredit	1.07	0.936721
Work Experience	1.88	0.530754
Mean VIF	1.31	

Source: Author's computation of field data, 2023

Membership in VICOBA

The estimation procedures start with determining the probability to belong to VICOBA by estimating a probit model which is equation 3.1 at 1%, 5% and 10% significant level. Results of estimation indicate that marital status significantly and positively affects the probability for a household to be a member of VICOBA, the same result as obtained by Duvendack (2010) on probability of microfinance

participation, showing that households with a married head are about 16% more likely to join VICOBA compared to those who are single. The household dependency size has also a positive and significant effect on membership in VICOBA groups, where the household's dependents increase has a higher probability (5%) of being members of VICOBA groups, this goes in contrast to estimation by Cintina & Love (2017), but concurs with the results by Ghalib et al (2011) who found that households with greater dependency ratio had a positive significant effect on the probability of joining microfinance programme. This reflects the fact that household members are in deprivation, inciting one of the members to join VICOBA may be with an expectation of gaining relief to accommodate the dependents. Other covariates which are age, gender, employment status, training, access to microcredit and working experience were found insignificant individually, partly contrary to Cintina & Love (2017) who found significant positive influence of age and gender (female) and negative influence of education on probability of joining microfinance programme. Farida et al., (2016) found gender to have positive and other loans (microcredit) to have negative significant influence. Although many variables are insignificant, the overall model was significant with Prob > chi2 = 0.0399, so these variables were significant to be included in the estimation of the model to improve the balancing property of the propensity score (Austin, 2011; Ghalib et al, 2011).

Table 4: Probit estimation of membership in VICOBA

Variable	Coefficients	Marginal effects (dy/dx)
Age	- 0.0037826 (0.0091624)	-0.0013497(0.00327)
Gender	-0.1758753 (0.1995059)	-0.0611343 (0.06732)
Marital status	0.4869904 (0.1896883) **	0.1614229 (0.05743) **
Dependents	0.1423543 (0.0580818)**	0.0507938 (0.02073)**
Training	0.1872583 (0.2027853)	0.0685346 (0.07593)
Education	-0.0036312 (0.0099277)	-0.0012957 (0.00354)
Employment	-0.0649559 (0.2686466)	-0.0229002 (0.09355)
Microcredit	0.1789046 (0.1577475)	0.0640343 (0.05651)
Work Experience	-0.0068434 (0.0090912)	-0.0024418 (0.00324)
Constant	-0.9467986 (0.4499891) **	
Log Likelihood	-182.54163	
Prob > chi2	0.0399	
Pseudo R^2	0.0445	
Number of obs.	302	

Standard errors in parentheses, ***p<0.01, **p<0.05, *p<0.1
Source: Author's computation of field data, 2023

i). Propensity Score Matching (PSM)

This section presents the treatment effects estimated from the PSM models to match the treated and the control 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 statistical test. The validity and quality of this evaluations procedure depends on matching of the calculated propensity score between treated and the untreated observations (Austin, 2011).

The PSM model matched individuals on treatment (VICOBA Members) with corresponding untreated counterpart (non-members) which had a similar propensity scores in a given range depending on the matching process. The propensity score was estimated using a probit model which included observable covariates thought to influence membership status. However, for PSM model to be sound, some assumptions or conditions have to be met, as discussed earlier in the methodology section (equations 3.4 up to 3.6). The checking processes in the estimation procedure were done to ensure the robustness of the estimated propensity scores and that the ATT is selection bias free.

The region of common support is selected by identifying the minimum and maximum propensity scores that are observed in both the treatment and control groups. In this paper, the region of common support varies from 0.0684898 to 0.6760723 which means that all observations below 0.0684898 or above 0.6760723 were not used in matching algorithm. The procedure ensures that the conditional independence assumption is satisfied in which both the treated and the control have a probability of being treated and not treated at the same time. Distribution of observations over the common support for matching is also depicted in figure 2. Another diagnostic process of a propensity score is the test of balancing property after the matching process to ensure that both the controls and the treated are no longer different in terms of the propensity score based on a set of covariates. The test for the balancing property is performed by comparing the means of propensity scores as well as covariates across both VICOBA members and non-members after matching algorithm(Pantaleo & Chagama, 2018).

The overlapping assumption ensures that both the treated and the controls have an overlap or a common range of a propensity score which is as stated in equation 3.6 above to create balanced sample. The Test for overlapping condition was performed using a kernel density graph (Figure 1). The test is meant to have one of the two results, if there is no overlapping of the propensity score between VICOBA members and non-members then PSM procedure is not good for comparison or impact analysis and if otherwise (if there is overlapping), then the procedures is suitable for comparison hence possible for impact analysis.

Table 5: Common support for propensity score matching

Treatment assignment	On support	Off support	Total
Untreated	203	0	203
Treated	98	1	99
Total	301	1	302

Source: Author's computation of field data, 2023

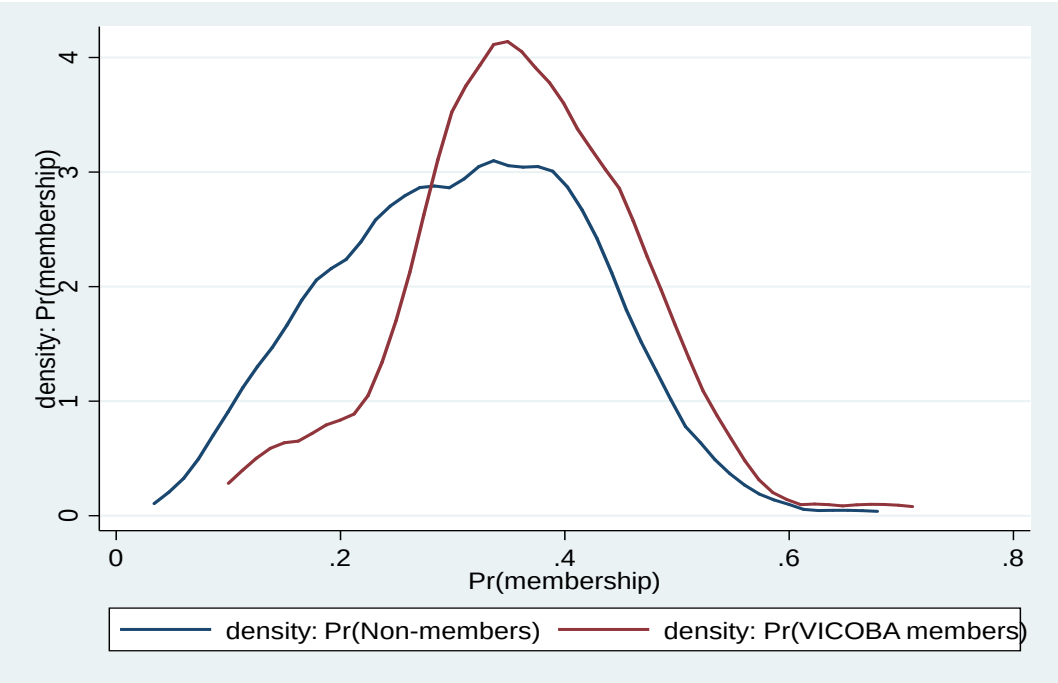

Figure 1: Kernel density of the estimated propensity score
Source: Author's Computations based on filed data described in the text

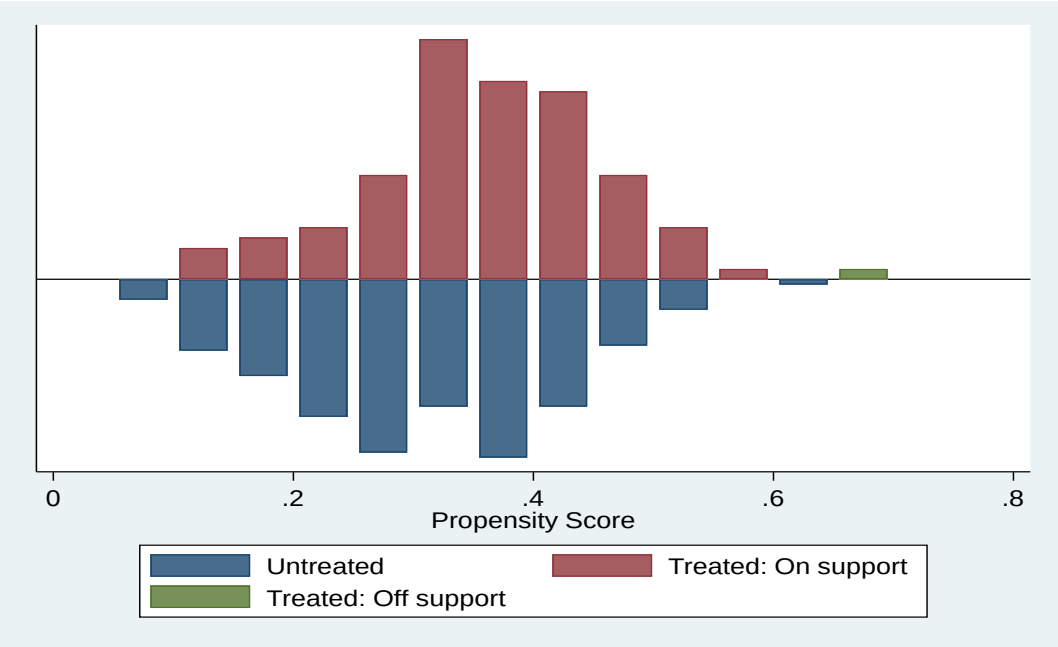

Figure 2: Propensity score graph for both VICOBA members and Non-members
Source: Author's Computations based on filed data

Nearest Neighborhood Matching (NNM) and Radius Matching estimations:
The NNM method chooses the closest score from the covariate of the control group. The process is good for treatment group and control group that tend to be similar (Farida et al., 2016). In the matching

process of PSM, 1 treated observation was out of common support so not used in matching. But NNM can lead to poor matches if the nearest neighbor has very different propensity score from the treated unit. So, radius matching can address the limitations as it matches each treated unit with control units that have propensity scores within a predefined radius of the treated unit's propensity score(Austin, 2011, 2014). The empirical estimations of the ATT based on the equation 3.7 developed in the methodology are as displayed in table 6 with NNM within 0.05 caliper and radius matching with default radius of 0.1.

Table 6: An impact estimator using propensity score matching

Variable	Sample	Treated	Controls	Difference	S.E.	T-stat
			Nearest Neighbor Matching			
Investment	Unmatched	355000	117576.36	237423.65	59616.58	3.98
	ATT	358418.37	74744.90	283673.47	67432.66	4.21***
			Radius Matching			
Investment	ATT	358418.37	83812.72	274605.65	69156.98	3.97***
Number of obs		= 302				
LR chi2(9)		= 17.02				
Prob > chi2		= 0.0484				
Pseudo R2		=0.0445				
Log likelihood		-82.54163				

***significant 1%, **significant 5% and *significant 10%
Unmatched=before matching, ATT=Average treatment on the treated
Source: Author's computation of field data, 2023

Impact estimation using linear regression:
In this all treated observations compared with all control observations in the region of common support. So, the average treatment effect (ATE) was estimated using equation 3.2 which is linear regression described in methodology part above at 1%, 5% and 10% levels of significance where the coefficient of interest that provides impacts of VICOBA is the estimated parameter of membership variable. The ATE is the average effect of the treatment across the entire eligible sample as it represents a weighted average of the treatment effects for treated and for those who did not receive the treatment. The results are as table 7 shows.

Table 7: An impact estimator by linear regression using weighted averages

	Investment		
Independent Variable	Coeff.	S.E.	t
Membership	285271.7***	63970.65	4.46
Age	-2252.006	4854.345	-0.46
Gender	-4669.439	58735.14	-0.08
Marital status	198105.9***	56916.1	3.48
Dependents	3792.075	23187.61	0.16
Training	131981.6	120225.6	1.10
Education	658.1927	3862.426	0.17
Employment	4012.563	94022.98	0.04
Microcredit	66999.22	63232.5	1.06
Work Experience	584.8225	4627.937	0.13
Constant	-91189.21	130281.9	-0.70
Number of obs	198		
F(10, 187)	2.51		
Prob > F	0.0075		
R-squared	0.1212		

***Significant 1%, **significant 5% and *significant 10%
Source: Author's computation of field data, 2023

ii) Endogenous Switching Regression (ESR)

Estimation of impacts by most of non-experimental methods fails to capture observable and/or unobservable characteristics that affect choice and outcome variables, For example, Propensity Score Matching controls for observable covariates under the assumptions of overlapping or regions of common support, the balancing property and unconfoundness assumption (Austin, 2011). In comparison to, using regression models to analyze the impact using pooled samples of members and non-members might be improper since it gives the similar effect on both groups (Sileshi et al., 2019). So an estimation approach that overcomes these limitations is endogenous switching regression (ESR).

The impact of VICOBA membership on household investment under the ESR approach follows two stages. The first stage, decision to join VICOBA is estimated using a binary probit model as selection. After estimating a probit model which is for equation 3.1 (choice equation), the second step is to estimate the two regime outcome equations which are equations 3.8 for treatment group and 3.9 for control group. The system of choice and two regime equations, that is equation (3.1), (3.8), and (3.9) are estimated simultaneously using full-information maximum likelihood method (Adlin, Mohd, & Gan, 2020).

Table 8: ESR Regression of Investment (Full Information Maximum Likelihood)

Variable	Investment		
	Selection Equation	Members	Non-Members
Constant	-0.9468 (0.4009)**	-18556.96	78.66972 (9806.255)
Age	-0.0036 (0.0084)	372.067	57.18275 (219.8387)
Gender	-0.1759 (0.1785)	-4221.754 (12449.13)	8702.089 (4232.589)**
Experience	-0.0068 (0.0083)	-572.0747	-75.68099 (210.1457)
Education level	-0.0036 (0.0089)	974.0188	636.3702 (231.9622)***
Employment	-0.065 (0.243)	-5558.63 (12905.92)	39435.23 (6134.779)***
Financial training	0.1873 (0.1845)	-4702.478 (11688.79)	-10479.14 (4859.828)**
Microcredit	0.1789 (0.1471)	9618.014 (14235.64)	-7068.801(3559.48)**
Marital status	0.487 (0.1822)***		
Dependents	0.1424 (0.0479)***		
σ0	406771.2**		
σ1	628872.5**		
ρ0	-0.6138		
ρ1	-0.1829		
Log likelihood	-4575.5845		
Number of obs	302		
Wald chi2(7)	20.38		
Prob > chi2	0.0090		

***p<0.01, **p<0.05 and *p<0.1. Standard errors in parentheses

Source: Author's computation of field data, 2023

To ensure the validity of the instruments to be used before running ESR with full-information maximum likelihood, the probit model for the equation 3.1 was estimated and OLS regressions for outcome equations (3.8), and (3.9) separately and checked in which equation these variables were effectually significant considering only 1% and 5% significance level to check for endogeneity and satisfying exclusion restriction. Nevertheless, the endogenous switching regression model is appropriate and valid method if the covariance σ0 and $\sigma 1$ are significantly different from zero and/or if one of the estimates of correlation coefficients ρ0 or ρ1 is statistically significant, which show the existence of selection bias due to unobserved covariates (Adlin et al., 2020; Christophe et al., 2021). So, for this case the method was valid to be used as the results in Table 8 shows. Then the average treatment effect on the treated (ATT) and the average treatment effect on untreated (ATU) were obtained by estimating equations 3.10 and 3.11. The results are shown in Table 9, where amounts are in Tanzanian shillings.

Table 9: Average treatment effects using Endogenous Switching Regression

Outcome variable	Treatment effect type	Decision stage		Treatment effect	t-stat
		To be a member	Not be a member		
Investment	ATT	355000	-7549.895	362549.9***	17.083
	ATU	479657.5	373299.6	106357.9***	6.595

***Significant 1%, **significant 5% and *significant 10%
Source: Author's computation of field data, 2023

Impacts of Village Community Banks (VICOBA) membership on household investment

Impact of VICOBA membership on household investment was captured by examining if household did invest some amount on income generating activity in any monthly within the period of 12 months prior to this research and it was found to have significant difference in investment between members and non-members across both methods of estimation.

Nearest neighbor matching results (Table 6) show investment difference after matching was TZS 283,673.47 and significant at 1% (significance level), where the average investment of VICOBA members (treatment group) was TZS 358,418.37 and the control group's was TZS 74,744.9, meaning that on average VICOBA members had higher investment than non-members. Radius matching resulted in ATT of TZS 274605.65, a bit less from NNM but significant at 1% too. Also, table 7 regression results show significant difference at 1% level of significance that on average VICOBA members had TZS 285,271.7 higher than non-members (coefficient estimates of membership variable). ESR estimates confirm the results by showing that VICOBA's impact was increase in investment by TZS. 362,549.9 on the treated and significant at 1% significance level (Table 9), which is greater but not far from PSM results. These results mean that VICOBA had positive impact on improving investment decision to members' households. Crépon et al, (2011) in Morocco had results compatible to this, that the microfinance generated significant increase in investment on assets especially for agricultural activities and self-employment associated with a substantial increase in profits. This also supports findings of some descriptive studies (Ollotu, 2017 and Massawe, 2020) which assessed and found that VICOBA had positive contribution to developing income generating activities in Tanzania.

The difference in magnitude of the impacts is because PSM algorithm rely on observable covariates to establish matched and comparable groups while ESR control for both observable and unobservable to reduce selection bias as individuals or groups are selected or self-select for membership on characteristics that may also affect their outcomes (Austin, 2011; Adlin et al., 2020). So, unobservable like risk taking behavior and psychological perception might have downward bias, so underestimated PSM results compared to ESR. On the other side, ATU shows that VICOBA membership would have significant positive impacts on investment even to non-members if they had involved in the programme, by having an increase of TZS 106,357.9 which is statistically significant at 1% level as compared to their investment while being out of VICOBA. This translates microfinance theory of change three vital steps which are; take a loan from (or save with) a microfinance institution (or similar entity), invest the money in a workable business and manage the business to yield major return on the investment, though this study didn't go into that third step to see if these investments produce expected major return. Probably VICOBA microloans and group saving resulted into temporal increase in income which was saved either in cash or assets other than being consumed and then investment.

1.7 Conclusion, policy implication and recommendations

Conclusion

The paper examined impact of Village Community Banks (VICOBA) on households' investment in Tanzania, the case of Kilosa District. An impact was evaluated by Propensity Score Matching (PSM) and Endogenous Switching Regression (ESR) to reduce the effects of self-select bias due to both observable and unobservable covariates and ensure consistence of the results. It was found in this paper that VICOBA membership significantly contributes to improving investment, therefore be an alternative that enables people to have quick and easy access of borrowing to develop or invest in their farm businesses or other income generating activities, and practice saving through their groups and insure against unexpected shocks.

Therefore the paper concludes that VICOBA practices have to be considered as one of the primary strategies for achieving financial inclusion and addressing financial challenges to improve access to credit and capital accumulation, hence investment which is essential for livelihood improvement especially for the rural farm households.

Policy implication and recommendations

Microfinance subsector's comprehensive transformation is required towards demand and access-based models that will affect the majority timely, because formal financial institutions alone cannot achieve the financial needs of the people in improving economic growth and poverty reduction. There is a need to add effort on technical, expertise and financial assistance through having legal and regulatory framework and integrating VICOBA in development plans. The government can play a role by providing technical assistance, financial resources, and regulatory support. Development partners can play a role by providing technical assistance and advocacy. This paper recommends that VICOBA be scaled up and that other financially excluded communities in and outside Tanzania. However, it is important to note that the study was conducted in a single district in Tanzania, and it is possible that the findings may not be generalizable to other parts of the country. More research is needed to confirm the findings of this study and to understand the long-term impact of VICOBAs on household investment.

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Appendices

Appendix 1: Descriptive statistics of household covariates and outcome variable

Characteristics	Description	Members Nt=99		Non-members Nc=203		Total sample N=302	
		Mean	SD	Mean	SD	Mean	SD
Age	Age of head in years	43.222	11.342	44.31	11.473	43.954	11.423
Gender	Dummy of gender (1=male)	0.182	.388	0.227	0.42	0.212	0.409
Marital status	Dummy of marriage (1=married)	0.848***	0.36	0.714	0.453	0.758	0.429
Dependents	Number of dependents	2.98 **	1.355	2.576	1.349	2.709	1.362
Training	Dummy for financial training (1=Yes)	0.212	0.411	0.163	0.369	0.179	0.384
Education	Level of education in number of year	12.485	9.571	12.897	9.679	12.762	9.629
Employment	Dummy for employment (1=Salaried employment)	0.121	0.328	0.123	0.329	0.123	0.328
Microcredit	Dummy for obtaining microcredit (1=Yes)	0.475	0.502	0.438	0.497	0.45	0.498
Experience	Working experience in years	19.162	11.896	20.379	11.896	19.98	11.89
Outcome variable							
Investment	Amount in IGA (TZS)	355000***	644625.7	117576.4	386859	195407.3	498188.3

***Significant 1%, **significant 5% and *significant 10%

Appendix 2: T-test mean comparison between VICOBA members and non-members

	Non-members Nc=203	**Members Nt=99**	**T-test N=302**	
	Mean	Mean	Mean difference	t
Characteristics				
Age	44.31	43.222	1.088	0.78
Gender	0.227	0.182	0.045	0.89
Marital status	0.714	0.848	0.134***	-2.58
Dependents	2.576	2.979	0.403**	-2.44
Training	0.163	0.212	0.049	-1.05
Education	12.897	12.485	0.412	0.35
Employment	0.123	0.121	0.002	0.05
Microcredit	0.438	0.475	0.037	-0.59
Experience	20.379	19.162	1.217	0.83
Easy of access to bank services				
Use/ownership of bank account	0.227	0.283	0.056	-1.06
Distance to nearest Bank	31.502	30.808	0.694	0.26
Outcome variable				
Investment	117576.4	355000	237423.6***	-3.98

***Significant 1%, **significant 5% and *significant 10% for mean difference

Appendix 3: Summary of VICOBA banking services (share and loans)

Variable	**Observations**	**Mean**	**Std. Dev.**	**Min**	**Max**
VICOBA share	99	6040.404	3559.75	1000	15000
VICOBA loan	99	112626.3	161210.9	0	600000

Mean, Minimum and Maximum values in TZS