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Original Paper

The Impact of Access to Finance on Household Welfare: Revisiting the Evidence from Uganda

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Abstract

Our paper highlights the role played by semiformal financial institutions in the livelihoods of Ugandan households that are not served by the commercial banks and microfinance institutions. Data from Living Standards Measurement Survey 2018 Uganda are used. We employ Propensity Score Matching and complement this with the two-step IV Treatment Effects method. We compare the effect of access to services from banks, Village Savings and Loans Associations, Rotating Savings and Credit Associations, and Savings and Credit Cooperatives on household welfare. We find a positive and statistically significant impact of access to both bank and semiformal financial services on household dietary diversity score; school enrollment rates; and clothing expenditure. The improvement in household welfare due to VSLAs, ROSCAs and SACCOs is comparable to that conferred by banks upon their customers. The results are robust to the method of estimation and we show that confounding factors are not a serious problem in our average treatment of the treated estimations. We also examine only those households that: (i) experienced drought; (ii) experienced drought, pests and heavy rains; (iii) were rural; (iv) had farming as main occupation; (v) were male-headed; (vi) had an education level below sample average. We find that in all cases bank, VSLA, ROSCA and SACCO member households have higher household dietary diversity score, school enrollment rates and clothing expenditure than control households. The policy implication from this study is that the improvement in welfare due to VSLAs, ROSCAs and SACCOs is relatively comparable to that obtained by commercial bank customers. Thus there is need to increase the geographic spread and depth of financial outreach of these semiformal institutions to increase the scale of financial inclusion in Uganda.

Keywords

Semiformal Financial Institutions, Household Welfare, Uganda

JEL Classifications: *C21, C26, D14, G21*

1. Introduction

The agricultural sector is among the key drivers of Uganda's economy accounting for 73% of employment, providing half of all exports, and one-quarter of GDP and therefore, enhancing its performance is central to food security and sustainable poverty reduction (World Bank, 2018). The agricultural sector plays an important role in terms of food and nutrition security, employment, local revenue, poverty alleviation, foreign exchange source and overall growth of the economy (NPA, 2013). According to the National Development Plan (NDP-III), pre-COVID-19 projections, agriculture is anticipated to be the second highest contributor to jobs, followed by industry whose largest share of jobs will arise from manufacturing. The NDP-III projections imply an increase in the proportion of households that are food secure (NPA, 2020). The majority of the population in Uganda is located in rural areas and is involved in agricultural activities. Like in other African countries, agriculture and many other non-farm sub-sectors in Uganda are under-capitalized. This has been a big drag on economic growth and poverty reduction. Therefore there is the need for increased rural financial intermediation in terms of depth and geographic spread in the rural areas to promote economic growth. According to the World Bank (2003), rural financial markets are important because financial intermediation facilitates general economic growth and poverty reduction.

Rural financial intermediation promotes economic growth and poverty reduction. Access to loans, deposits, payments, and insurance services spurs entrepreneurship, innovation, and household production. Access to reliable and good savings and credit instruments, payment services, and reliable insurance mechanisms enables poor households to reduce vulnerability by smoothing consumption and mitigating risks. Since most rural income exhibits high variability in their cycles, access to financial intermediation enables inter-temporal allocation of purchasing power between net savers and net investors/spenders at any given time. Access to working capital or investment credit offered by rural finance institutions can substantially accelerate the adoption of modern agricultural technologies and production patterns invariably increasing the level of food security and resilience to covariate climate change shocks in agriculture. Access to appropriate credit instruments is known to enable rural entrepreneurs to harness investment opportunities in nonfarm enterprises. In addition, increased access to liquid savings deposits and fixed term deposit services encourages the accumulation of financial assets. This can be for lump sum investments/expenditures or for inter-temporal consumption smoothing to mitigate the effects of irregular income streams (World Bank, 2003).

According to Zeller et al. (1997), household savings reduce disposable income and consumption in the current period but increase it for future periods. For food-insecure households, savings in the form of cash, food, and other assets are an important means of self-insurance against both anticipated and unexpected times of food insecurity. Household borrowing increases current disposable income at the expense of available income in future periods. Household borrowing enables investment in education

and health as well as physical assets to improve inter-temporal future income and consumption prospects. Access to credit services and not the actual borrowing, also plays the role of self-insurance against both future idiosyncratic and covariate shocks.

Zeller *op cit*, indicate that food security, at the household level, in the most basic form is access by all people at all times to the food needed for a healthy life. Food insecurity includes temporary shortfalls of adequate food for a proper diet (transitory food insecurity) as well as a long-term food shortfalls (chronic food insecurity). Teklu et al. (1992) also show that poor households often diversify their income sources, dispose of their assets, or engage in informal or formal credit and savings markets to cope with transitory food insecurity. Access to finance has been shown to get the poor out of poverty by raising household incomes and consumption (Agbola et al., 2017; Banerjee et al., 2015; Chen & Snodgrass, 2001; Dunn & Arbuckle Jr, 2001; Dupas & Robinson, 2013; Hossain, 1988; Karlan & Zinman, 2011; Khandker, 2001; Pitt & Khandker, 1996; Stewart et al., 2010; Wright, 2011; Zaman, 1999). Access to finance has been shown to improve educational attainment and improved health status (Pitt et al., 1999; Pitt & Khandker, 1996). In general, access to microfinance reduces poverty by increasing incomes, health care, nutrition and education attainment, and women empowerment (Bhatt & Tang, 2001; Cheng & Degryse, 2010; Collins et al., 2010; Dunford, 2001; Hartarska & Nadolnyak, 2008; Hermes & Lensink, 2011; Khandker, 2005; Morduch, 1998, 2000).

2. An Overview of Semiformal Institutions in Uganda

In Uganda it is evident that commercial banks and traditional microfinance institutions cannot reach very many poor households due to the costs involved. Poor households instead turn to semiformal financial institutions for services. According to the Uganda 2018 FinScope Survey (FSD Uganda, 2018), there are still many challenges to increasing the breadth and depth of formal financial inclusion in Uganda due to supply and demand factors. Supply side factors include the high transaction costs incurred by commercial banks and traditional microfinance institutions in serving rural areas. These transaction costs, most often than not, prevent these formal financial institutions from increasing their penetration of the rural areas in terms of depth and outreach. The demand factors include that fact that most adult Ugandans rely on relatively unstable sources of income in terms of cash flow. These type of individuals do save and borrow small amounts and prefer highly liquid assets (FSD Uganda, 2018). Therefore there has evolved a system of semiformal organizations to fulfill the needs of poor households with less costly transaction costs. These include Village Savings and Loan Associations (VSLAs), Rotating and Savings Credit Associations (ROSCAs) and Savings and Credit Cooperatives (SACCOs). For instance, VSLAs have been making efforts in Uganda to improve poor households' access to credit by creating groups of people who can pool their savings in order to have a source of lending funds. ROSCAs too provide opportunities to save and borrow. However, they do not allow savers to earn interest on their deposits. ROSCAs do not provide a means for borrowing at will because though each member makes a regular deposit to the common fund, only one lottery-selected member is able to keep the proceeds from each meeting.

VSLAs attempt to overcome the difficulties of offering credit to the rural poor by building on the ROSCA model to create groups of people who can pool their savings in order to have a source of lending funds. Members make savings contributions to the pool, and can also borrow from it. As a self-sustainable and self-replicating mechanism, VSLAs have the potential to bring financial services closer to the poor in terms of depth and outreach. SACCOs are akin to ROSCAs but are more formal institutions. In a ROSCA all the members contribute a fixed amount of money each week, the total of which is given to one of the members. This cycle is repeated until every member receives the fund at least once, that is, the funds rotate around the members (Peterlechner, 2009). However, SACCOs are more advanced financial institutions that are owned, managed and run by their members who have a common bond, such as geographic location, same business organization or employer, same community and members possess equal voting rights (Branch, 2005). The objectives of a typical SACCO include promoting the welfare and economic interests of its members, providing savings facilities and credit at favorable interest rates, training of members in business skills, poverty reduction and cooperation. In Uganda, the government has encouraged the formation of SACCOs to increase outreach and access to financial services by the poor in rural areas. SACCOs offer commercial and agricultural loans at interest rates of 13% and 9%, respectively.

Our study focuses on the role played by several semiformal financial institutions, that is, VSLAs, ROSCAs, and SACCOs in the food security, education and income growth opportunities of poor households in Uganda. The question put forward is: Can poor households get welfare benefits from VSLAs, ROSCAs and SACCOs comparable to those commercial banks confer upon their clients? Thus we test the hypothesis that semiformal financial institutions do confer welfare benefits upon their clients that are comparable to those commercial banks confer upon their customers.

3. Conceptual Framework

The first stage of our conceptual framework is that an individual has to make a choice first on whether or not to acquire a savings instrument at a financial institution. We use savings instrument as the cornerstone of our analysis since getting unsecured loans is also tied to acquiring a savings instrument first. We consider an individual (household head or spouse) that has been exposed to information on what it means to access financial services from any given institution, formal or semiformal. We assume the individual possesses good information from a government body or NGO on what happens when they acquire a financial savings instrument at any given financial institution. The household has to make a choice between acquiring the savings instrument or not from the financial institution exposed to them (Bank, VSLA, ROSCA or SACCO). We denote the random variable Y_i that represents the binary choice of the i^{th} person and takes a value of 1 when the choice is made and zero if not. The average utility derived from the choice is dependent on both the attributes of the choice (e.g. distance to the financial institution, loan collateral requirements of the institution) and attributes specific to the individual (e.g. level of education, age, income, income stability). The individual attributes do not vary across the two choices.

For the i^{th} individual, we denote the random utility derived from the two choices as average utility and a random error term as the choice to acquire a savings instrument = 1 and not to = 0 given by:

$$(1) \quad U_1 = \mathbf{Z_1'\theta + W'\delta_1} + e_1$$
$$U_0 = \mathbf{Z0'\theta + W'\delta 0} + e_0$$

Where **Z** represent vectors of characteristics of the two choices as perceived by the individual and **W** is the vector of the socio-demographic characteristics of the i^{th} individual. The individual chooses to acquire a savings instrument from a VSLA or ROSCA only if $U_1 > U_0$ or if the unobservable or latent random variable $Y_i^* = U_1 - U_0 > 0$. The values of the observable random variable Y_i are given by:

$$(2) \quad Y_i = 1, \text{ if } Y_i^* > 0.$$
$$Y_i = 0, \text{ if } Y_i^* < 0.$$

Y_i^* can be rewritten as

$$(3) \quad Y_i^* = \mathbf{(Z_1 - Z_0)'\theta + W'(\delta_1 - \delta_0)} + (e_1 - e_0)$$

The regression model is observed only if $Y_i^* = 1$ and is given as:

$$(4) \quad Y_i = \mathbf{X'\beta} + e^*$$

where assume a standard normal probability distribution of the error term in (4) and the *probit* model in (4) is a regression of the dependent variable on a vector of explanatory variables **X**; and **β** is vector of parameter estimates, e is random error term.

The second stage of our conceptual framework is that after an individual has decided to acquire a savings instrument at a financial institution, we assume they derive a higher utility from that choice than what they would have got had they not acquired the savings instrument. We test this hypothesis of a higher utility derived by comparing the values of selected household outcomes that are associated with making the choice of acquiring a savings instrument at a financial institution. Let us take the average household dietary diversity score (HDDS) as the outcome variable. We compare the mean HDDS for individuals who made the choice to acquire a savings instrument with the mean HDDS for those who did not. To avoid confusion with equations (1) to (4) we denote our choice/indicator variable for VSLA savings account holders or treatment individuals as D = 1 and D = 0 for the control individuals. For VSLA savers we have the *observed mean* HDDS under the condition of choosing to open a savings account as $E[HDDS_1|D = 1]$. The *unobserved mean* HDDS that the treatment households would have realized had they indeed not chosen to open a savings account is given as $E[HDDS_0|D = 1]$. Asymptotic theory shows

that the expected value of a random variable is the mean of that variable. The subscript 1 is for treatment cases and subscript 0 is for control cases. Similarly, for control individuals we have the *observed mean* HDDS under the condition of non-participation in VSLA services as E [$HDDS_0$ |D = 0]. In practice we do not observe E [$HDDS_0$ |D = 1] so instead we proxy this with the observed mean HDDS under the condition of non-participation in VSLA services, which is E [$HDDS_0$ |D = 0] as shown in (5) below. The parameter of interest in this study is the *average treatment effect on the treated* group (ATT) where

(5) ATT = E [$HDDS_1$ |D = 1] – E [$HDDS_0$ |D = 0].

For the ATT to be free from self-selection bias, we have to match VSLA savers and non-savers in as many household characteristics as possible to have a very close approximation such that:

(6) E [$HDDS_0$ |D = 1] = E [$HDDS_0$ |D = 0]

where for VSLA savers we have the *unobserved mean* HDDS under the condition of *not choosing* to open a savings account as E [$HDDS_0$ | D = 1] which approximates the for control individuals we have the *observed mean* HDDS of the control households denoted as E [$HDDS_0$ |D = 0].

4. Methodology

We compare the impact of access to semiformal financial institution services to that of access to commercial bank financial services. We use quasi-experimental statistical methods. The indicator variable in our study takes a value of 1 if the household had access to bank, VSLA, ROSCA and SACCO financial services and 0 if they did not save/borrow from any semiformal, bank, microfinance or any other form of formal institution at all. We use the Propensity Score Matching (PSM) method. We check the robustness of our results by also complementing the analysis with the two-step Treatment Effects (IV Sample Selection method).

4.1 The Propensity Score Matching (PSM)

To evaluate the impact of accessing financial services from banks and semi-formal financial institutions on household welfare, we first control for potential differences between the treatment and control cases. To control for possible hidden selection bias, this study uses the Propensity Score Matching (PSM) method following Rosenbaum and Rubin (1983), Dehejia and Wahba (2002), Jalan and Ravallion (2003), DiPrete and Gangl (2004), Smith and Todd (2005), Mendola (2007), and Caliendo and Kopeinig (2008). We denote the indicator variable for bank savers/borrowers or treatment cases as D = 1; and D = 0 for non-bank savers/borrowers or control cases. We know from asymptotic theory that the expected value of a random variable is the mean of that variable. For bank saver/borrower households, we have the observed mean of the outcome variable under the condition of treatment as E [Y_1 |D = 1], and the unobserved mean of the outcome variable that the household would have realized had they not indeed

saved/borrowed from a bank as E [Y_0 |D = 1]. Similarly, for non-bank savers/borrowers, we have the observed mean of the outcome variable under the condition of not acquiring a savings instrument at a bank as E [Y_0 |D = 0]. The parameter of interest in this study is the *average treatment effect on the treated* group (ATT) where

(7) $ATT = E[Y_1 | D = 1] - E[Y_0 | D = 0]$.

4.2 Testing Robustness of Results

Before matching the treatment and control samples, the two cohorts differ in both observed and unobserved characteristics. After matching and controlling for the quality of matching, the assumption is that there might be an unobserved confounding factors that explains why there are differences between the treatment and control households, for instance, in terms of the level food security or normalized household expenditure. Following Rosenbaum (2002, 1987) we generate estimates of the magnitude of hidden selection bias that are necessary to invalidate the ATT study findings. We shall also supplement the Rosenbaum tests with another test for hidden selection bias.

4.3 The Treatment Effects Model (IV Sample Selection Regression)

The decision to accessing financial services from banks and semi-formal financial institutions might be exogenous to the households so we shall test whether accessing financial services is endogenous using the Wu-Hausman test, where the null hypothesis that accessing financial services from banks and semi-formal financial institutions is exogenous. If the null is rejected, then we employ the two-step Treatment Effects Model (IV Sample Selection Regression) that also explicitly controls for hidden selection bias and compare the results from this model with those obtained using Propensity Score Matching method.

The outcome variable is Y_i, the indicator variable is D = 1 for bank/VLSA/ROSCA/SACCO saver/borrower households, and D = 0 for the control households. $\mathbf{X}_i$ as a vector of explanatory variables, $\boldsymbol{\beta}$ is a vector of parameter estimates. We have the OLS outcome regression model given by:

(8) $Yi = \beta' \mathbf{X}i + \delta Di + \varepsilon i$

where δ is the estimate of the impact of Bank/VLSA/ROSCA/SACCO SACCOs on the outcome variable and εi is the error term. However, confounding factors will bias the estimate of δ. We use a two-stage approach while controlling for hidden selection bias. The first stage is the *probit* model where we regress the *treatment indicator variable*, D_i, on a vector $\mathbf{X}_i$ of explanatory variables and a vector $\mathbf{Z}_i$ of instruments:

(9) $D_i = \boldsymbol{\beta}'\mathbf{X}_i + \boldsymbol{\gamma}'\mathbf{Z}_i + v_i$

From first principles we denote D_i^* as the latent treatment selection variable and thus have:

(10) $D_i^* = \boldsymbol{\theta}'\mathbf{w} + u_i$,

$D_i = 1$ if $D_i^* > 0$,

$D_i = 0$ if $D_i^* \leq 0$,

The regression model observed only if $D_i = 1$ and is given as:

(11) $Y_i = \boldsymbol{\beta}'\mathbf{X}_i + \varepsilon_i$

Thus

(12) $E[Yi|Di = 1] = \boldsymbol{\beta}'\mathbf{X}_i + \beta_\lambda\lambda(\boldsymbol{\theta}'\mathbf{w})$

where the sample selectivity correction, $\lambda(\boldsymbol{\theta}'\mathbf{w})$ is the inverse Mills ratio or the hazard function for the incidentally truncated distribution. The predicted values of the treatment indicator variable in (9) above are used in the second stage OLS regression that is given by:

(13) $Yi = \boldsymbol{\beta}'\mathbf{X}i + \delta IVD + \beta_\lambda\lambda(\boldsymbol{\theta}'\mathbf{w}) + \varepsilon i$

where the treatment impact is now given by the parameter δ_{IV} and the instrument variables in the vector $\mathbf{Z}_i$, are assumed to be correlated with adoption or treatment D, but not with the error vector ε_i. Following Khandker (2005) we generate the vector zi of instruments used in the treatment effects selection equation as follows. We choose the number of residential houses and number of commercial buildings owned by the households as two instruments not affecting the outcome variables but affecting treatment since they are indication of the potential of the household's creditworthiness. We create additional instruments for the probit model selection equation by interacting the two instruments indicated above with all the covariates in the $\mathbf{X}_i$ vector in the outcome equations.

5. The Data

The study employs household survey data from the World Bank's Living Standards Measurement Surveys (LSMS) for Uganda. The LSMS for Uganda is the Uganda National Panel Survey (UNPS) 2018-2019 (UBoS, 2020), which consists of a sample of about 3,200 households, all previously interviewed as part of the 2005/2006 Uganda National Household Survey (UNHS) (UBOS, 2006). The UNPS is conducted in two visits, where a household is interviewed twice in a year with the visits six months apart. This is done in order to capture agricultural information, because Uganda has two cropping seasons. Data collected during the UNPS are at the individual, household, and community levels and

these include, *inter alia*, data on education, health, income, expenditure, wealth, infrastructure and services. The UNPS involves tracking and re-interviewing about 3,200 households that are distributed over 322 enumeration areas (EAs) which are selected out of 783 EAs that were initially visited under the 2005/06 UNPS. The UNPS data used in our study covers the initial sample that was visited in the period 2018/2019.

5.1 Indicator and Outcome Variables

In this study we restrict our sample to households that use the services of and actually saved in: (i) banks; (ii) VSLAs; (iii) ROSCAs; and (iv) SACCOs. Bank savers/borrowers are just one of the treatment groups. The control cases are households who had nothing to do with any formal or semiformal institutions at all. Similarly VSLA savers/borrowers are just another one of the treatment groups. The *indicator variable* is bank or VSLA or ROSCA or SACCO which takes a value of 1 for treatment cases and a value of zero for control cases. We made an effort to check the data for each category of indicator variable by sorting the data in the following way. From the data obtained from the World Bank LSMS Survey 2018-2019 for Uganda, we constructed two groups of households that shared similar characteristics: (i) a control group (households that did not use any services from banks, Microfinance Institutions, Microfinance Deposit-taking Institutions, VSLAs, ROSCAs, or SACCOs); and (ii) a participating group (households that used the services of banks, VSLAs, ROSCAs, and SACCOs). The participating group had four sub-samples. First we had households that only used the services of banks and nowhere else. Second, households that only used the services of VSLAs and nowhere else. Third, households that only used the services of ROSCAs and nowhere else and finally household that only used the services of SACCOs and nowhere else. Using these matched groups, we estimate the impact on household welfare of accessing services from banks, VSLAs, ROSCAs, and SACCOs. We investigate the impact of access to bank, VSLA, SACCO, or ROSCA services on household welfare with respect to a number of *outcome variables*. These are: (i) Household Dietary Diversity Score (HDDS); (ii) Expenditure on Clothing; (iii) School Enrollment Rates. HDDS is a food security proxy variable. Expenditure on clothing is derived from the fact that clothes make an important category in the family budget in most developing countries. The literature shows that access to finance affects the school enrollment rates in most households.

The HDDS is a standard proxy indicator for food security, which capture household food consumption and dietary diversity (Kennedy et al., 2011; Kennedy et al., 2010; Hoddinott & Yohannes, 2002). The HDDS uses a standard list of 16 food groups aggregated into 12 main groups with all the food categories having the same weight (WFP & FAO, 2012; Kennedy et al., 2011). It uses a 24 hour recall period and is an indication of household access to food and nutrition. However, due to data limitations, we computed the HDDS as the number of Yes scores (Yes = 1; No = 0) for the number of different food categories consumed by the each household in the *last seven days prior to the UNPS*. For instance, a score of 8 indicates the household consumed eight different food groups in the last seven days prior to the interview. The different categories considered in our study were: (a) cereals (includes rice, maize, sorghum, millet, bread, porridge, beer residue); (b) pulses/legumes (includes beans, groundnuts, peas, sesame, green

grams, sunflower); (c) roots/tubers (includes cassava, sweet potatoes, potatoes, yams); (d) vegetables (includes greens, cabbages, okra, kale, spinach, tomatoes, onions); (e) all types of fruit and fruit juices; (f) meats, poultry, offals, blood; (g) any fish type; (h) eggs; (i) milk/milk products (excluding ghee, butter); (j) oils/fats(including ghee, butter); (k) sugar/honey (including sugarcane and molasses); (l) coffee, tea, condiments. The number of Yes = 1 scores for each household reflect the nutritional quality of the diet. A higher HDDS indicates a higher level of access to food and nutritional quality. Annual household expenditure on clothing was computed for each household for the sample. School enrollment rate was computed as the number of children (including ages 18 years and above) in primary, secondary and tertiary institutions divided by the total number of children of the household.

6. Results

6.1 Quality of Covariate Balancing

The results of quality of matching or covariate balancing are shown in the Table 1 below. As expected, matching achieves a reduction in the standardized bias, the pseudo-R2, the likelihood ratio Chi-square and the statistical significance of the Likelihood ratio Chi-square. The reduced pseudo-R2 indicates that covariates have very low explanatory power for selection into the treatment group. The reduced statistical significance shown by the p-values of the Likelihood Ratio Chi-square indicate that there are no systematic differences in the distribution of covariates between the treatment and control cases after matching. That is, the hypothesis that both cohorts have the same distribution in the covariates after matching cannot be rejected. We run the covariate balancing tests for all the models in the study and the results are in the Appendix.

6.2 Impact of Access to Financial Services on HDDS

6.2.1 Full Sample Results

Tables 1 (a) and (b) below shows the results from the propensity score matching (PSM) and IV treatment effects methods. The data used are for the full sample of the treatment and control cases. Table 1(a) shows the estimated ATT using the Epanechnikov kernel matching algorithm (PSM). The results show that households that held savings with banks, VSLAs and ROSCAs have a higher mean household dietary diversity score (HDDS) than that of the control households. The difference between the treatment and control households' HDDS is the ATT. Thus access to bank, VSLA and ROSCA financial services has a positive effect on the HDDS given the observed selection variables. For bank households, the difference between the mean HDDS for the treatment group and the mean HDDS for the control group is statistically significant. Access to commercial bank financial services by a household, on average, increases their HDDS by 6.60 percent relative to that of the control households. Similarly access to VSLA financial services by a household, on average, increases their HDDS by 5.37% relative to that of the control households. For the ROSCA households, the increment in HDDS is 6.41% relative to that of the control households. The percentage interpretation comes from comparing the mean HDDS of the treatment group and that of the control group. In Table 1(b) are the ATT estimates for IV Treatment

Effects method. The results in Table 1(a) using the PSM are comparable to those in Table 1(b) using the IV Treatment Effects method as shown below.

Table 1 (a). PSM Model: Impact of Banks, VSLAs, ROSCAs and SACCOs on Household Welfare

Institution	Outcome Variable	ATT	t-value	HiddenBias (Γ)	Number of Matched Pairs
BANK	HDDS	0.589**	2.55	2.00 = 5% 2.15 = 10%	295
VSLA	HDDS	0.453***	3.59	1.75 = 5% 1.80 = 10%	544
ROSCA	HDDS	0.556**	2.57	1.50 = 5% 1.65 = 10%	97
BANK	School Enrollment Ratio	0.0829*	1.85	1.35 = 5% 1.40 = 10%	279
VSLA	School Enrollment Ratio	0.0794***	3.52	1.50 = 5% 1.60 = 10%	532
SACCO	School Enrollment Ratio	0.1532***	3.67	1.75 = 5% 1.95 = 10%	111
BANK	Clothing Expenditure (UG. SHS)	241,047***	4.83	3.20 = 5% 3.40 = 10%	292
ROSCA	Clothing Expenditure (UG. SHS)	93,772***	2.64	1.35 = 5% 1.50 = 10%	94
SACCO	Clothing Expenditure (UG. SHS)	88,116***	4.32	1.50 = 5% 1.65 = 10%	

Note. ***, **, * indicate significance at 1%, 5%, and 10%, respectively. Value of gamma (Γ) at 5% and 10% level of significance. *Exchange Rate is US$1.00 = Shs 3,600*

Table 1 (b). IV Treatment Effects Model: Impact of Banks, VSLAs, ROSCAs and SACCOs

Institution	Outcome Variable	ATT	t-value	Hazard Lambda (p-value)	Number of Observations
BANK	HDDS	0.835***	2.79	-0.233 (0.207)	963
VSLA	HDDS	0.673*	1.94	-0.204 (0.300)	1134
ROSCA	HDDS	0.766**	2.06	-0.175 (0.467)	712
BANK	School Enrollment Ratio	0.1150*	1.92	-0.012 (0.748)	916
VSLA	School Enrollment Ratio	0.1189*	1.70	-0.038 (0.384)	1095
SACCO	School Enrollment Ratio	0.1520*	1.67	-0.014 (0.801)	703
BANK	Clothing Expenditure (UG. SHS)	185,584*	1.73	-56,853 (0.377)	889
ROSCA	Clothing Expenditure (UG. SHS)	122,023*	1.66	-25,815 (0.530)	704
SACCO	Clothing Expenditure (UG. SHS)	91,305*	3.04	-9,784 (0.606)	729

Note. ***, **, * indicate significance at 1%, 5%, and 10%, level of significance, respectively.
p-values are in parentheses. *Exchange Rate is US$1.00 = Shs 3,600*

6.3 Impact of Access to Financial Services on Education

6.3.1 Full Sample Results

We show in Table 1(a) above that access to financial savings instruments at commercial banks, ROSCAs, VSLAs and SACCOs confers benefits on households in terms of empowerment to make positive decisions to invest more in education. The results are for the school enrollment rates (computed as the number of children in primary, secondary and tertiary institutions divided by the total number of children of the household). The results show that treatment households have a higher mean school enrollment rate

than that of the control households. The difference in school enrollment rate between treatment and control households is positive and statistically significant for all financial institutions. For commercial bank treatment households, access to bank services confers unto them the ability to increase investment in education at primary, secondary and tertiary institutions. Bank households, on average, have a higher school enrollment rate than that of the control households by 15.40%. Similarly access to VSLA financial services by a household, on average, increases their school enrollment rate by 16.70% relative to that of the control households. For the ROSCA households, the figure is 16.10% relative to that control households. For SACCO households, the figure is 30.40% relative to that of control households. From these findings we posit that a household may have a life cycle motive whereby having access to financial services allows the household the flexibility of making investments in education. With access to savings and borrowing from financial institutions, households are expected to decrease the probability of being liquidity constrained across time periods. This inter-temporal flexibility increases likelihood of marginal increments in long-term investments such as the education of children. We also show the matched households' mean characteristics in Table 2(a) below. Therefore it cannot be argued that, on average, the treatment group household sizes and wage incomes were far different from those of the control group which would explain the large difference in school enrollment rates between the two groups.

Table 2(a). School Enrollment Rate: Selected Matched Mean Household Characteristics

Institution	Treatment	Control	p-value
BANK	Mean	Mean	
HHSize	7.46	7.42	0.892
AgeHHH	45.09	45.48	0.727
AgeSpouse	39.30	40.12	0.449
EducHHH(Years)	10.95	10.71	0.519
EducSpouse(Years)	9.71	9.22	0.163
WageIncome(UG.SHS)	5.2e+06	4.0e+06	0.185
ROSCA			
HHSize	7.52	7.22	0.520
AgeHHH	43.18	42.46	0.722
AgeSpouse	36.51	36.43	0.963
EducHHH(Years)	7.94	7.09	0.123
EducSpouse(Years)	6.99	6.32	0.208
WageIncome(UG.SHS)	1.3e+06	1.1e+06	0.659
VSLA			

HHSize	7.54	7.41	0.492
AgeHHH	41.99	41.63	0.637
AgeSpouse	37.01	36.62	0.583
EducHHH(Years)	7.71	7.58	0.554
EducSpouse(Years)	6.19	6.08	0.583
WageIncome(UG.SHS)	9.5e+05	8.9e+05	0.738
SACCO			
HHSize	7.41	7.41	0.994
AgeHHH	44.14	43.72	0.807
AgeSpouse	37.90	37.47	0.794
EducHHH(Years)	8.43	8.21	0.665
EducSpouse(Years)	7.46	7.17	0.548
WageIncome(UG.SHS)	1.6e+06	1.4e+06	0.787

Source: Survey Data. Exchange Rate is US$1.00 = Shs 3,600.

6.4 Impact of Access to Financial Services on Clothing Expenditure

6.4.1 Full Sample Results

Table 1(a) above shows that the estimated impact of access to financial services on annual household clothing expenditure is positive and statistically significant for bank, VSLAs, ROSCAs and SACCOs. The difference between the mean annual household expenditure on clothing for the bank treatment and control groups is about UG. SHS 241,047 (US$67). This difference is statistically significant. The difference between the mean annual household expenditure on clothing for the ROSCA treatment and control groups is about UG. SHS 93,772 (US$26) AND statistically significant. Similarly, this difference between the mean annual household expenditure on clothing for the SACCO treatment and control groups is about UG. SHS 88,116 (US$24) and is also statistically significant. **In Table 2(b) below** we indicate that the mean household size of the bank treatment group is not statistically different from that of the control group after matching the data of the two cohorts. For instance, after PSM Kernel matching, the mean household size for the bank treatment group is 7.54 and that of the control group is 7.57. The difference between the two household size means is not statistically significant (p-value = 0.908). Furthermore, we also show that the mean household size of the ROSCA treatment group is not statistically different from that of the control group after matching. That is, mean ROSCA treatment group household size is 7.14 and that of the control group is 6.99 (p-value = 0.742). We get similar results from the SACCO treatment and control groups. That is, mean SACCO household size is 7.28 and control group is also 7.25 (p-value = 0.941). In addition, the mean wage incomes are not statistically significant for all treatment and control groups for the banks, ROSCAs and SACCOs. Therefore it cannot be argued

that, on average, the treatment group household sizes and wage incomes were far greater than those of the control groups which would explain the large difference in clothing expenditure between the two groups.

Table 2(b). Clothing Expenditure: Selected MATCHED Household Characteristics

Institution	Treatment	Control	p-value
BANK			
HHSize	7.54	7.57	0.908
AgeHHH	44.98	45.24	0.814
AgeSpouse	39.21	39.83	0.561
EducHHH(Years)	10.94	11.10	0.715
EducSpouse(Years)	9.69	9.25	0.201
WageIncome(UG.SHS)	5.0e+06	3.8e+06	0.173
ROSCA			
HHSize	7.14	6.99	0.742
AgeHHH	42.62	43.03	0.835
AgeSpouse	36.26	36.24	0.992
EducHHH(Years)	7.82	7.48	0.517
EducSpouse(Years)	7.06	6.57	0.340
WageIncome(UG.SHS)	1.2e+06	1.2e+06	0.956
SACCO			
HHSize	7.28	7.25	0.941
AgeHHH	44.29	44.12	0.920
AgeSpouse	38.22	38.14	0.959
EducHHH(Years)	8.53	8.39	0.787
EducSpouse(Years)	7.57	7.16	0.379
WageIncome(UG.SHS)	1.8e+06	1.4e+06	0.450

Source: Survey Data

This finding is consistent with the study by Dupas and Robinson (2013) who conducted a randomized control trial (RCT) in Kenya for savings and find a positive impact on private expenditures, especially for market women. However, some studies that have used randomized evaluation methods find no statistically significant impacts of savings on non-food expenditures (Beaman et al., 2014; Karlan et al., 2017). For example, Karlan et al. (2017) find no impact of savings on non-food expenditures (such as

transport, clothing, electricity, and petrol) for a clustered randomized evaluation spanning three African countries which include Ghana, Malawi, and Uganda. Our findings suggest that after controlling for household size and annual wage income, treatment households spend more on clothing than the control households due to the intertemporal flexibility in consumption smoothing opportunities provided by the access to financial services from banks, ROSCAs and SACCOs.

Holvoet (2004) examines the effect of microfinance on children's education in India. She examines the household behavior of both female and male in terms of investment in child education when there is improved access to loans. She finds that participation in women's savings and loans groups significantly increases the probability that children are kept in school longer and become literate. Children in households where loans were accessed through women's savings and loan groups remained, on average, 1 to 1.5 years longer in school. In addition, they were, on average, 2.7 to 3.5 times more probable that they will be able to read and write.

6.5 Access to Financial Services and Household Welfare Conditional on Drought

Table 3(a) below show the results where we considered only those households that reported having experienced drought as a covariate shock. We stratified the data into*: (i) drought-stricken households; and (ii) drought-pests-heavy rains stricken households.* We eliminated from this drought *sub-sample* all households that had not suffered drought shock. We then divided this drought sub-sample into two cohorts. That is, treatment and control cases. The results for HDDS Table 3(a) below. Because of data limitations in terms of number of observations, we only considered households that had savings at VSLAs and the control cases. For only those households that suffered a drought shock, we show that VSLA treatment households still have a higher mean HDDS than that of the control households. That is, access to VSLA financial services by a household, on average, increases their HDDS (under the condition of drought shock) by 8.42% relative to that of the control households (also under the condition of drought shock). We obtain similar results for the HDDS under the condition of combined drought, pests and heavy rains shocks (DPR shocks) as shown in Table 3(b) below. Therefore conditional on drought shocks, access to finance from VSLAs confers a higher level of food and nutritional security to households than that of household with no access to semiformal institutions.

Table 3 (a). PSM Model: Impact of VSLAs on HDDS Conditional on a Drought Shock

Institution	Outcome Variable	ATT	t-value	HiddenBias (Γ)	Number of Matched Pairs
VSLA	HDDS	0.6484**	2.04	1.40 = 5% 1.55 = 10%	111

Note. ***, **, * indicate significance at 1%, 5%, and 10%, respectively. Value of gamma (Γ)

at 5% and 10% level of significance.

Table 3 (b). PSM Model: Impact of VSLAs on HDDS Conditional on DPR Shocks

Institution	Outcome Variable	ATT	t-value	HiddenBias (Γ)	Number of Matched Pairs
VSLA	HDDS	0.5738**	2.26	1.45 = 5% 1.60 = 10%	152

Note. ***, **, * indicate significance at 1%, 5%, and 10%, respectively. Value of gamma (Γ) at 5% and 10% level of significance.

Our results are in tandem with those of Mwansakilwa et al. (2017) who examine the effect of VSLAs on household consumption expenditure using data from Eastern and Western Zambia. They find a large positive and statistically significant consumption effects of participation in VSLAs. Karlan et al. (2012) indicate that there are small improvements in food security, with VSLA households less likely to reduce the food consumption of adults in the household due to shocks. USAID (2019) started a project of developing VSLAs in the Sikasso Region of Mali. They report that VSLA members now have increased access money essential and emergency expenditures. Ksoll et al. (2016) found that VSLAs had a positive and significant intention-totreat impact on the household number of meals consumed per day, household expenditure and the number of rooms in the dwelling. Beaman et al. (2014) conclude that in Mali, savings have a positive impact on food security. Dupas and Robinson (2013) find that savings in Kenya have positive impact on food expenditure, especially for market women. Van Rooyen et al. (2012) note that the findings of Dupas and Robinson (2013) suggest that increased household food expenditures can be linked to increased food quality. Zeller and Sharma (2000) argue that savings provide a pathway to smooth consumption in difficult times. Inter-temporal consumption smoothing through savings helps households deal with income shocks or unexpected increases in expenditures. In Uganda vulnerable HHs self-insure against idiosyncratic risks across periods by holding precautionary savings in the form of relatively liquid assets (Kiiza & Pederson, 2006). Thus households that hold precautionary savings are able to adjust their income and consumption and in turn stabilize their food security through diet diversity, quantity and quality of food.

6.6 Financial Services and Household Welfare under Different Strata

We again examine the impact of access to financial services from banks, VSALs, ROSCAs and SACCOs under different sub-samples (strata). We stratified the data into: (i) only rural households; (ii) only households where farming is the main income occupation; (iii) only male-headed households; and (iv) only households where the head has below sample average level of education. We stratified data into (i) and (ii) above since the majority of the households served by the VSLAs, ROSCAs and SACCOs are

either located in the rural areas or have farming as the major occupation of the household head. We also stratified data into (iii) above since various empirical studies show that male- headed households do poorly in household food and nutrition security compared to female-headed households. Furthermore, we stratified data into (iv) above because we posit that illiterate or low literacy household heads may tend not to attach a lot of importance to child education since they too as parents did not get far in school. Tables 4(a) to (d) below show that for all four strata above: bank, VSLA, ROSCA and SACCO member households have higher HDDS, clothing expenditure and school enrollment rates than the control households. Thus the results of the impact of access to financial services on household welfare are robust to whichever of the four strata we have selected. The results are also similar to those from the full sample analyses. We find that the welfare effects conferred upon poor households by VSLAs, ROSCAs and SACCOs are comparable to those conferred by commercial banks upon their customers in all the six data strata.

Table 4(a). ONLY RURAL Households: Impact of Banks, VSLAs, ROSCAs and SACCOs

Institution	Outcome	ATT	T-value	Hidden Bias (Γ)	No. Matched pairs
VSLA	HDDS	0.5725***	3.84	1.70=5%	403
				1.80=10%	
ROSCA	HDDS	0.5857**	2.08	1.35=5%	60
				1.50=10%	
Bank	Enrollment	0.1018**	1.96	1.45=5%	89
				1.60=10%	
VSLA	Enrollment	0.0821***	3.21	1.50=5%	392
				1.60=10%	
ROSCA	Enrollment	0.1055*	1.87	1.15=5%	56
				1.30=10%	
SACCO	Enrollment	0.1507***	2.91	1.70=5%	70
				1.95=10%	
Bank	Clothing	146,863***	3.84	1.95=5%	107
				2.15=10%	
ROSCA	Clothing	71,303***	3.11	1.55=5%	61
				1.75=10%	
SACCO	Clothing	91,688***	4.19	1.80=5%	78
				2.00=10%	

Note. ***, **, * indicate significance at 1%, 5%, and 10%, respectively. Value of gamma (Γ) at 5% and 10% level of significance. *Exchange Rate is US$1.00 = Shs 3,600*

Table 4(b). ONLY FARMER Households: Impact of Banks, VSLAs, ROSCAs and SACCOs

Institution	Outcome	ATT	t-value	Hidden Bias (Γ)	No. Matched pairs
Bank	HDDS	0.9533***	2.60	2.35=5%	79
				2.60=10%	
VSLA	HDDS	0.4024**	2.29	1.40=5%	291
				1.45=10%	
VSLA	Enrollment	0.0872***	2.87	1.65=5%	262
				1.75=10%	
SACCO	Enrollment	0.1560**	2.12	1.95=5%	37
				2.30=10%	
Bank	Clothing	170,766***	4.58	2.30=5%	76
				2.55=10%	
ROSCA	Clothing	63,557**	2.56	1.20=5%	45
				1.35=10%	
SACCO	Clothing	107,236***	2.89	1.45=5%	39
				1.65=10%	

N *Note*. ***, **, * indicate significance at 1%, 5%, and 10%, respectively. Value of gamma (Γ) at 5% and 10% level of significance. *Exchange Rate is US$1.00 = Shs 3,600*

Table 4(c). ONLY MALE-HEADED Households: Impact of Banks, VSLAs, ROSCAs and SACCOs

Institution	Outcome	ATT	t-value	Hidden Bias (Γ)	No. Matched pairs
Bank	HDDS	0.5738**	2.37	1.95=5%	267
				2.10=10%	
VSLA	HDDS	0.4687***	3.46	1.65=5%	495
				1.75=10%	
ROSCA	HDDS	0.5485**	2.32	1.40=5%	84
				1.50=10%	

Note. ***,**,* indicate significance at 1%, 5%, and 10%, respectively. Value of gamma (Γ) at 5% and 10% level of significance.

Table 4(d). ONLY Low Education Households: Impact of Banks, VSLAs, ROSCAs and SACCOs

Institution	Outcome	ATT	T-value	Hidden Bias (Γ)	No. Matched pairs
Bank	Enrollment	0.1227*	1.78	1.25=5%	30
				1.50=10%	
VSLA	Enrollment	0.0789**	2.35	1.35=5%	192
				1.45=10%	
SACCO	Enrollment	0.3175***	4.77	2.70=5%	27
				3.40=10%	

Note. ***,**,* indicate significance at 1%, 5%, and 10%, respectively. Value of gamma (Γ) at 5% and 10% level of significance.

The Ministry of Financial Planning and Economic Development (MoFPED) and Bank of Uganda (BoU), initiated the formulation the National Financial Inclusion Strategy (NFIS) 2017-2022. This is an overall strategy intended to promote financial inclusion with emphasis on five objectives. These are: (i) reduce financial exclusion and barriers to accessing financial services; (ii) develop the credit infrastructure; (iii) build the digital infrastructure; (iv) deepen and broaden formal savings, investment and insurance usage; and (v) protect and empower individuals with enhanced financial capability. The development goal of increased financial inclusion is the reduction of poverty and increased economic security of households through access to affordable financial services.

Our results in Tables 1(a) to 4(d) above show that households with access to financial services from banks, VSLAs, ROSCAs and SACCOs have higher: (a) household dietary diversity score; (b) school enrollment rates; and (c) clothing expenditure, than the control households. Thus these results fit in the narrative of the NFIS (2017-2022) that there is need to increase financial inclusion and reduce the barriers to accessing financial services. We have shown that the welfare effects conferred upon poor households by VSLAs, ROSCAs and SACCOs are comparable to those conferred by commercial banks upon their customers. Therefore, it is imperative that the actual implementation of the NFIS should focus on both formal and semiformal financial institutions in equal measure if the five objectives of the NFIS (2017-2022) are to be realized.

6.7 Tests for Robustness of the Results

We test for robustness of the results using several methods. First, we use the Propensity Score Matching method and check for the effect of confounding factors through the Rosenbaum bounds. Following Rosenbaum (1987, 2002), we generate estimates of the magnitude of the parameter gamma Γ and check its value at 5% and 10% level of significance. The closer Γ is to the value of 1.0, the more sensitive the findings are to small amounts of hidden selection bias. In our study we report the results where the lowest value of Γ is 1.20 at 10% level of significance. We consider this a safe point that is far enough away from Γ = 1.0 to allay concerns about the influence of unobserved confounding on the ATT estimates. All the

other estimates of Γ are far enough from 1.0 and are above 1.20 and indicate that our ATT estimates are not very sensitive to hidden selection bias at 5% and 10% level of significance (see Tables in the Appendix). Second, we check whether the results are robust to the method of estimation. We also urn the two-step IV Treatment Effects method while controlling for hidden selection bias and examine the coefficient of Lambda λ, the hazard function. In all cases coefficient on λ is not statistically significant. This implies that hidden selection bias has been catered for in the estimation and is not a serious problem for our findings.

7. Conclusions

Data from the Living Standards Measurement Survey 2018-2019 show that about 72% of the households interviewed were served by semiformal financial institutions (VSLAs, ROSCAs and SACCOs). The goal of our paper is to highlight the importance of semiformal financial services in the livelihoods of those households that are not served by the commercial banks and traditional microfinance institutions. We show that the impact of access to both formal and semiformal financial services on household welfare is positive and statistically significant in all cases. The results are robust to the method of estimation. Tests show that confounding factors are not a serious problem in our average treatment of the treated (ATT) estimations

We compare the effect of accessing commercial bank financial services to that of accessing financial services from VSLAs, ROSCAs and SACCOs on household welfare. The magnitude of the impact on household welfare due to accessing commercial bank services is comparable to that due to accessing services from VSLAs, ROSCAs and SACCOs. Therefore, we conclude that semiformal financial institutions play a key role in improving household welfare similar to that of commercial banks.

We also stratify the data into: (i) only households that experienced drought; (ii) only households that experienced drought, pests and heavy rains; (iii) only rural households; (iv) only households where farming is the main income occupation; (v) only male-headed households; and (vi) only households with an education level that is below the sample average. Our results show that in all six strata above, bank, VSLA, ROSCA and SACOO member households have higher household dietary diversity score, school enrollment rates and clothing expenditure than the control households. The policy implication from this study is that VSLAs, ROSCAs and SACCOs seem to be the poor households' commercial banks since these semiformal institutions confer almost similar benefits to those of commercial banks. Thus there is need to increase the geographic spread and depth of financial outreach of the VSLAs, ROSCAs and SACCOs to increase the scale of financial inclusion in Uganda. These results have important poverty alleviation implications since VSLAs, ROSCAs and SACCOs do not require substantial investment in physical and institutional infrastructure in order to serve the marginalized households with financial services. In addition, it is imperative that the actual implementation of the National Financial Inclusion Strategy (NFIS) 2017-2022 for Uganda should focus on both formal and semiformal financial

institutions in equal measure in order to realize poverty reduction and increased economic security of households.

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APPENDIX A:

Table A1. PSM Covariate Matching Quality for Full Sample

Institution	Outcome	Un-Matched Sample			Matched Sample		
		Pseudo R^2	$p > \chi^2$	Mean Bias	Pseudo R^2	$p > \chi^2$	Mean Bias
Bank	HDDS	0.338	0.000	24.635	0.024	0.875	5.066
VSLA	HDDS	0.074	0.000	10.418	0.004	1.000	2.151
ROSCA	HDDS	0.174	0.000	14.788	0.017	1.000	4.059
Bank	Enrollment	0.388	0.000	31.020	0.053	0.225	6.023
VSLA	Enrollment	0.086	0.000	9.849	0.006	1.000	2.776
SACCO	Enrollment	0.260	0.000	19.843	0.021	1.000	3.671
Bank	Clothing	0.365	0.000	30.301	0.040	0.543	6.441
ROSCA	Clothing	0.192	0.000	15.158	0.021	1.000	4.762
SACCO	Clothing	0.255	0.000	20.172	0.034	1.000	4.776

Source: Survey Data

Table A2. PSM Covariate Matching Quality for Drought Shock Sample

Institution	Outcome	Un-Matched Sample			Matched Sample		
		Pseudo R^2	$p > \chi^2$	Mean Bias	Pseudo R^2	$p > \chi^2$	Mean Bias
VLSA	HDDS	0.190	0.003	14.136	0.046	0.997	6.341

Source: Survey Data

Table A3. PSM Covariate Matching Quality for DPR Shocks Sample

Institution	Outcome	Un-Matched Sample			Matched Sample		
		Pseudo R^2	$p > \chi^2$	Mean Bias	Pseudo R^2	$p > \chi^2$	Mean Bias
VLSA	HDDS	0.183	0.000	11.752	0.035	0.999	5.302

Source: Survey Data

Table A4. PSM Quality of Covariate Matching for ONLY Rural Households

Institution	Outcome	Un-Matched Sample			Matched Sample		
		Pseudo R^2	$p > \chi^2$	Mean Bias	Pseudo R^2	$p > \chi^2$	Mean Bias
VSLA	HDDS	0.074	0.000	10.469	0.004	1.000	2.139
ROSCA	HDDS	0.209	0.000	19.082	0.019	1.000	5.395
Bank	Enrollment	0.352	0.000	23.292	0.031	1.000	6.569
VSLA	Enrollment	0.078	0.000	10.726	0.010	0.999	3.698
ROSCA	Enrollment	0.241	0.000	20.290	0.033	1.000	6.305
SACCO	Enrollment	0.285	0.000	21.318	0.051	1.000	7.091
Bank	Clothing	0.328	0.000	21.590	0.080	0.787	10.789
ROSCA	Clothing	0.226	0.000	18.495	0.040	1.000	8.129
SACCO	Clothing	0.272	0.000	21.523	0.040	1.000	5.788

Source: Survey Data

Table A5. PSM Quality of Covariate Matching for ONLY Farmer Households

Institution	Outcome	Un-Matched Sample			Matched Sample		
		Pseudo R^2	$p > \chi^2$	Mean Bias	Pseudo R^2	$p > \chi^2$	Mean Bias
Bank	HDDS	0.358	0.000	28.823	0.051	0.997	8.121
VSLA	HDDS	0.099	0.000	11.304	0.005	1.000	3.173
VSLA	Enrollment	0.096	0.000	11.229	0.035	0.622	6.972
SACCO	Enrollment	0.239	0.000	23.458	0.044	1.000	8.589
Bank	Clothing	0.347	0.000	29.095	0.046	0.999	7.146
ROSCA	Clothing	0.249	0.000	19.709	0.074	0.995	10.208
SACCO	Clothing	0.231	0.000	23.592	0.039	1.000	8.249

Source: Survey Data

Table A6. PSM Quality of Covariate Matching for ONLY Male Headed Households

Institution	Outcome	Un-Matched Sample			Matched Sample		
		Pseudo R^2	$p > \chi^2$	Mean Bias	Pseudo R^2	$p > \chi^2$	Mean Bias
Bank	HDDS	0.350	0.000	26.962	0.027	0.866	5.576
VSLA	HDDS	0.083	0.000	10.642	0.004	1.000	1.927
ROSCA	HDDS	0.156	0.000	15.561	0.009	1.000	3.569

Source: Survey Data

Table A7. PSM Quality of Covariate Matching for ONLY Households with Low Education Head

Institution	Outcome	Un-Matched Sample			Matched Sample		
		Pseudo R^2	$p > \chi^2$	Mean Bias	Pseudo R^2	$p > \chi^2$	Mean Bias
Bank	Enrollment	0.344	0.000	21.634	0.073	1.000	9.438
VSLA	Enrollment	0.092	0.004	12.163	0.049	0.727	8.643
SACCO	Enrollment	0.285	0.004	28.059	0.119	0.994	16.544

Source: Survey Data

APPENDIX B:

Table B.1 IV Treatment Effects Model: Impact of VSLAs on HDDS Conditional on Drought Shock

Institution	Outcome	ATT	t-value (p-value)	Hazard Lambda	No of Obs
VSLA	HDDS	0.9366*	1.70 (0.271)	-0.3931	252

Note. ***, **, * indicate significance at 1%, 5%, and 10%, respectively. Value of gamma (Γ) at 5% and 10% level of significance.

Table B.2 IV Treatment Effects Model: Impact of VSLAs on HDDS Conditional on DPR Shocks

Institution	Outcome	ATT	t-value (p-value)	Hazard Lambda	No of Obs
VSLA	HDDS	0.9910*	1.86 (0.243)	-0.3400	336

Note. ***, **, * indicate significance at 1%, 5%, and 10%, respectively. Value of gamma (Γ) at 5% and 10% level of significance.