

Formal and informal finance and rural household welfare in Mezam division of the North-West Region of Cameroon: A comparative assessment

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Abstract: The purpose of this study is to comparatively assess the impact of formal and informal finance on rural household welfare in the Mezam division of the Northwest region of Cameroon. A probit regression model was used to examine the determinants of households' credit access, while a Propensity Score Matching and an Endogenous Switching Regression model were used to analyze the impact of formal and informal finance on household welfare. The results from the probit regression model indicate the importance of occupation, extension services, and household participants in accessing credit. On the other hand, a prediction from the propensity score matching and endogenous switching regression model confirms that access to either formal or informal finance has an impact on welfare, with informal finance having a positive and significant impact.

Keywords: Cameroon, Endogenous switching model, Formal and informal finance, Household welfare.

1. Introduction

Over the years, especially in developing countries, credit has been used as a development tool, in targeting the poor and vulnerable household. In many developing countries, access to rural credit has long been considered a potential solution to the liquidity constraints of households that fail to improve their welfare or develop their livelihoods [1]. Owing to the high degree of ambiguity and riskiness of agricultural productivity and rural welfare in particular, access to finance is crucial in improving the livelihood of the rural population. Access to finance is fundamental to develop and maintain the necessary infrastructure, equipment, and service that they provide to rural householders to better improve their livelihood [2]. Access to credit helps the rural household in a number of ways. Access to credit significantly increase ability of households with no or few savings to meet their financial needs for agricultural inputs and productive investments [3]. Access to credit could also increase rural poor households' willingness to adopt new technologies that raise both productivity and welfare [4]. Finally, access to credit allows rural households to smooth their consumption in the case of adverse event [5]. According to Akudugu [6] availability of credit enables poor households against illiteracy, and starvation and all other adversities that impinge on their welfare. As such, access to credit by rural household is expected to generate income through micro-activities, smooth consumption and consequently enhance their wellbeing [7]. Many studies have shown that by providing rural households with access to financial service, their agricultural productivity and quality of life improve [8-10]. Unfortunately, because of lack of collateral and high transaction costs, the poor and vulnerable cannot access formal financial credit [11]. This limited access to credit is likely to produce an unpleasant result towards the achievement of the poverty reduction goals particularly in developing countries [12].

Like many African countries, Cameroon has a huge percentage of its population living in rural areas. According to world bank report De Siqueira [13] approximately 45% of the total population lives in rural areas and depends on agricultural activities for their livelihood. As of 2014, the poverty rate in the rural area was estimated to be approximately 58 percent [13]. In the same vein, an evaluation of the Cameroon poverty reduction strategy paper IMF [14] reveals that poverty has increased by close to 3 points especially in the rural areas. In this regard, limited access to credit by rural farmers was recognize as on of the main factors that causes poverty and poor living standard. As such, Sikod and Baye [15] and Schrieder and Heidhues [16] established a positive relationship between credit access and rural household welfare in Cameroon. Hence, access to rural credit has long been considered a potential solution to the liquidity constraints of rural households that fail to improve their welfare or livelihood [1, 17]. The provision of credit has widely been acknowledged as a promising strategy for poverty reduction [18]. Therefore, accessibility to credit is considered an important resource towards improving rural household welfare [19]. Rural households in Cameroon often borrow from formal and informal finance [15]. According to Köhler, et al. [20] the formal credit source includes commercial banks, government banks, credit unions and cooperatives societies, while the informal credit sector includes rotating credit and savings association, non-rotating credit and savings associations, reciprocal\individual finance (examples include neighbors, friends, and family) and commercial finance (moneylenders). In Cameroon, the formal credit sector is yet to cover most rural households due to high operating costs and less opportunity for profit [20]. Also, lack of collateral security has excluded the poor households from accessing formal finance. Failure to access credit through the formal sector has resulted in the emergence of informal institutions aimed at administering credit to meet the demand of the rural household [21, 22]. Furthermore, the lack of required collateral for formal credit and the convenient accessibility of informal credit has resulted in the latter being sustainable despite charging high interest rates [21]. Although the informal sector is known to charge high interest on loans, they continue to play and important role in the rural areas, due to their convenient accessibility [23]. As such, there is need to understand the differential impact of formal and informal finance on the welfare of rural households in the North-West region of Cameroon. As such, the objective of this study is to estimate the effects of access to formal and informal finance on rural household welfare in the North-west region of Cameroon.

While it is apparent and generally agreed upon that access to credit has a positive effect on household welfare Manja and Badjie [24] there are limited studies that have evaluated the differential impact of formal and informal credit access on rural household welfare in Cameroon.

Paramount among the limitations is the difference in concept and econometric model. Many researchers have examined the impact of microfinance on household welfare in Cameroon [22, 25-27]. accessed the impact of microcredit on the welfare of household in Cameroon. These studies failed to take into account the different type of credit (formal and informal credit) which affects household welfare. In addition, Bime and Mbanasor [22] evaluate the determinants of access to credit and their impact on the sustainability of small and medium size enterprises in Cameroon. As it stands, most studies in the field only focused on formal finance due to measurement challenges associated with informal finance [25-27]. Therefore, this study seeks to fill the existing gap to provide empirical evidence on the differential

2. Literature Review

In the literature, many studies have examined the impact of credit access to household welfare. In these studies, one frequently used measure of welfare is household consumption and consumption expenditure [9, 24, 28, 29]. Empirical studies conducted under this context suggest that, access to credit impacts household welfare [7, 23, 24]. While studying the impact of informal credit on poverty and inequality in Vietnam, Cuong and Marrit.vanden [30] found out that, credit access has a positive and significant impact on poverty reduction. The study also showed that poor households get better credit proportion from informal finance than formal finance. In a Similar study carried out in Northern

Ethiopia, Berhane and Gardebroek [31] acknowledge that, enhancing access to credit among rural households improves welfare by improving consumption in the short as well as in the long run.

Similarly, Sivchou, et al. [32] analyze the credit situation in Prek Norin community in Cambodia and realize that credit improves the standard of living through creating job opportunity that facilitate the increment of income and asset. According to Langat, et al. [33] credit access and household welfare have a positive relationship. Household that participates in credit market stand a chance of having a better welfare than household than those that do not have access credit. Credit helps to increase households' economic welfare through improving per-capital income, expanding food and non-expenditure [34]. Access to finance was also found to influence better living standards and job opportunities from two villages (Prektachreng and Prek Krouch) in Prek Norin Community [35]. In addition, it improves household education, women's status, family welfare and also helps in reducing income inequality among villagers Teng, et al. [35]. Soh, et al. [36] found that financial inclusion will improve access to housing credit for more household which would reduce their income inequality.

Salia [37], examined the effect of microcredit on the household welfare in Tanzania and found out that, credit contributes to reduction of poverty and improvement of household welfare by providing opportunity to acquire asset that will be used to finance education, businesses and medical expense of the household. In a similar study that focus on analyzing the effect of informal credit on household welfare, Tonch and Sohn [38] used a two-stage least square regression and realized that, informal credit is positively associated with welfare in Ethiopia. This insinuates that, 28 US\$ received in the form of informal credit will improve the household expenditure by approximately 4.3 percent. Furthermore, Akudugu [6], used the hierarchical competitive welfare model approach and observed that, household with access to formal credit will witness an increase in its welfare expenditure, while those that access informal credit will witness a decrease in their welfare expenditure. Similarly, Ofori-Abebrese, et al. [39] discovered that for sub-Sahara African countries, financial inclusion will lead to an improvement in education of individuals and later translates into higher income and thus an improvement in their welfare.

Beside household welfare, Wezi, et al. [40] examined the impact of access to either formal or informal credit on household food security in Malawi. With the use of Tobit and an Endogenous Regime Switching approach, the results showed that, access to formal credit improves household food security, while access to informal household worsens food security.

3. Materials and Methods

3.1. Sampling technique

A structural questionnaire was used to carry out survey at rural household level. Rural household in Mezam Division of the North-West region of Cameroon was selected as target group for this study. This division was selected because it is one of the largest agricultural divisions of the North-West Region. This division is also the headquarter (capital) of the North-West Region, which means, it offers a rich opportunity in terms of available market for the rural farmer. Generally, if Cameroon maintains its position as the breadbasket of the central African sub-region, one of the areas to be credited is the Mezam division, which is a major agricultural production division, involved particularly in horticulture [41]. The North West-region comprises of seven divisions namely; Boyo, Bui, Donga-Mantung, Menchum, Mezam, Momo, and Ngo-Ketunjia

This study employed a multistage sampling procedure. The first step involves selecting one division (Mezam division) out of the seven divisions. The second stage involve a simple random selection of four (Santa, Bamenda II, Bamenda II and Tubah) out of the seven sub divisions (Bafut, Bali, Bamenda I, Bamenda II, Bamenda III, Santa, and Tubah) in Mezam division. Finally, from each subdivision sixty-two simple random selection was carried out, making a total of 247 respondents.

This study used a simplified formular provided by Yamane [42] indicated in equation (1), to determine the required sample size at 95% confidence level, 0.5 degree of variability, and 9% level of precision (0.09)

$$n = \frac{N}{1 + Ne^2}$$

Where,

n is the sample size

N is the population size (total number of household heads) and

e is the level of precision.

Accordingly, the above formula requires a minimum of 82 respondents, but the study was carried out on 247 respondents.

3.2. Analytical Framework

To compare the impact of formal and informal financial access on household welfare in Cameroon, the impact evaluation study employed the counterfactual approach of analysis [43]. Two treatment groups (1. Households that access credit from formal finance and 2. Households that had access to credit from informal finance) were compared. Drawing from the questionnaires and the non-randomization of the data, the study engaged the quasi-experimental study approach, specifically the propensity score matching (PSM). With the nature of the data, the method is expected to yield unbiased and valid estimates. The main issue is that access to finance by household is not random, as households' access to finance is mainly dependent at times on land status, level of education and most at times occupation status. As such, to address the problem of endogeneity the study used the endogenous switching regression technique. Therefore, to address the existing analytical gap in this study, two econometric models were used. The models are the Propensity score matching and the endogenous switching regression technique to ensure an unbiased estimation and consistency of findings

3.2.1. Propensity Score Matching (PSM)

To estimate the differential impacts of access to formal and informal finance on households' welfare in the North-West region of Cameroon, the study uses impact evaluation (IE) analysis. An impact evaluation basically involves assessing the impact of a program on a set of outcomes of interest. According to Gertler, et al. [44] this involve assessing the causal effect of the program on the outcomes, so as to identify the changes directly attributable to those programs, their modality, or design innovations. This process helps to overcome the challenge of establishing causality by empirically establishing the extent to which a program contributes to the change in outcome [44]. The PSM makes use of observable characteristics in a sample unit to generate a control group that is comparable to the treated group following exogenous characteristics [28]. This model is constructed following two main assumptions. The first assumption is that of un-confoundedness (conditional independence) and the second assumption is that for matching to be satisfactory, a common support condition needs to be satisfied [45]. The impact of a program (P) on an outcome of interest (Y) can be presented as the difference between the outcome (Y) in the presence of the program and the same outcome (Y) without the program. Mathematically, this can be represented using the formula below

$$\Delta = (Y/P = 1, X) - (Y/P = 0, X) \quad (1)$$

For this analysis, the impact of finance access (Δ) is the difference between a household's welfare (Y) after gaining access to either formal or informal (i.e when $P = 1$: $P = 0$). Also, the Propensity scores are generated (ranging from 0 to 1) from the regression by a Probit estimation [46].

The generated propensity is as follow,

$$C_i = \alpha + \beta X_i + \varepsilon_i \quad (2)$$

Where C is binary variable credit access (formal finance = 1, informal finance = 0), X is a vector of household characteristics, and ε_i is an error term. There exist different algorithms used in PSM for matching samples. Each of these matching methods is specific and unique in its way and is used to match access to formal finance and access to informal finance [24]. The matching methods considered

in this study are; Kernel matching (KM), Nearest Neighbor matching (NNM), and Radius matching (RM).

After generating the propensity scores, the covariates balancing property and the overlap over the determined common support are investigated [1]. The overlap assumption enables comparable treatments between formal credit finance and informal credit finance. However, to handle the issue of dimensionality, Rosenbaum and Rubin [47] showed that if the potential outcome of the treated (Y_1) and the control (Y_0) are independent of the treatment variables conditioned on the covariates (X), this implies that they are also independent of the treatment conditional on the generated propensity score as shown in the equation below

$$P(D = 1/X) = P(X) \quad (3)$$

Several different techniques can be used to check the quality of covariates in the match [48]. In this study, the method used in checking the balancing quality of the covariates is the standardized bias of each of the covariates used in the matching. The absolute difference in sample means between the treatment and the comparison groups are observed in percentages to ensure that there is no significant difference and that they are close to 0 and 1 before and after matching respectively [47]. The last step of PSM consists of calculating the average treatment effect on the treated (ATET), the calculated mean between the matched groups (formal credit finance and informal credit finance) is done following previous studies Manja and Badjie [24]; Hossain, et al. [23] and Moahid, et al. [49] presented as follows;

$$ATET = E[Y_1/V = 1, \text{Prob}(x)] - E[Y_0/V = 1, \text{Prob}(x)] \quad (4)$$

Where Y_1 is the outcome variable for formal credit finance.

Y_0 is the outcome variable for informal credit finance.

V is the credit access decision for formal or informal credit finance.

3.2.2. Switching Regression Model (ESR)

Based on questionnaire response, households were categorized into formal and informal credit access household. Following Maddala [50] an Endogenous Switching Regression Model (ESR) was used in the analysis. The Endogenous Switching Regression Model allows for joint estimation of the determinants of households' credit access and whether the household welfare is affected by those who had access to credit via formal or informal financial institutions. The analysis of this study was carried out using STATA software package. The ESR model estimates the effects of credit access on the outcome variable by considering two equations: One for those household that access credit through formal finance and the other for those households that access credit through informal finance. The possibility of self-selection bias arises due to the fact that credits are targeted toward certain households. In this situation, we suppose there are some unobservable characteristics of the household that influence their access to credit both in formal and informal financial institutions. In this regard, self-selection bias is the source of endogeneity problem, and failure to take into account such problem will overstate the true impact of credit access on the household welfare. Therefore, an estimation method is needed to correct for this bias and obtain an unbiased estimation [28].

Following Maddala [50] the credit constrained condition of a household (designated i) is presented using a probit function with the following specification:

$$C^*_i = \alpha Z_i + \varepsilon_i \quad (5)$$

$$C_i = 1 \text{ if } C^*_i < 0 \text{ (Credit Unconstrained, formal credit finance)} \quad (5a)$$

$$C_i = 0 \text{ if } C^*_i > 0 \text{ (Credit constrained, informal credit finance)} \quad (5b)$$

Equation (5b) indicates the degree to which a household has access to credit from an informal finance, and is given by the index C_i^* which is a latent variable as the author cannot directly observe households demand for credit [51]. This index is explained by Z_i which represents a vector of the explanatory variables; α represent the parameter to be estimated, and ε_i is the random error term, distributed as a normal function with null mean. Since $C_i^* > 0$ is unobservable, credit status is first estimated using a probit model which estimates the probability of a household to access credit.

The probability of a household having access to credit $C_i=1$ is written as:

$$\text{Prob}(C_i=1) = \Lambda(\alpha Z_i) = \frac{\exp(\alpha Z_i)}{1+\exp(\alpha Z_i)} \quad (6)$$

As mentioned earlier, to address the possibility of selection bias issue, an (ESR) model is applied. This choice of model is agreed by Moahid, et al. [49] and Maddala [50]. Previous studies Mbaye [52]; Baiyegunhi, et al. [53] and Minh, et al. [54] have used this model in their analysis. Therefore, the household welfare is estimated using the following equation with regime 1 representing household with access to credit (via formal institution) and regime 0 representing household with access to credit (via informal institution)

$$y_{1i} = \beta_1 X_{1i} + \varepsilon_{1i} \text{ if } C_i=1 \quad (7)$$

$$y_{0i} = \beta_0 X_{0i} + \varepsilon_{0i} \text{ if } C_i=0 \quad (8)$$

Where y_{1i} and y_{0i} represent household welfare with access to credit through formal and informal financial institution respectively; β_1 and β_0 are the vector parameters; X represent the various explanatory variables; ε_{1i} and ε_{0i} are the error terms. The covariance of the error term is unknown since y_{1i} and y_{0i} cannot be observe simultaneously. Therefore, ε_{1i} , ε_{0i} and ε_i (equation 1) are assume to have a normal distribution with a mean vector of zero and a covariance matrix.

$$\text{Cov}(\varepsilon_{1i}, \varepsilon_{0i}, \varepsilon_i) = \begin{pmatrix} \delta_1^2 & \rho_{10} & \rho_{1\varepsilon} \\ \rho_{10} & \delta_0^2 & \rho_{0\varepsilon} \\ \rho_{1\varepsilon} & \rho_{0\varepsilon} & 1 \end{pmatrix}$$

Where δ_1^2 , δ_0^2 , represent the variance of the error terms ε_{1i} , ε_{0i} in the welfare functions in equation (7) and (8). $\rho_{1\varepsilon}$ is the covariance of ε_{1i} and ε_i ; while $\rho_{0\varepsilon}$ is the covariance of ε_{0i} and ε_i . $\rho_{1\varepsilon}$ and $\rho_{0\varepsilon}$ are the correlation term between household credit access status in equation (1) and impact of welfare in equation (7) and (8). If $\rho_{1\varepsilon}$ and $\rho_{0\varepsilon}=0$, then it is assumed that there is no problem with selection bias. However, if $\rho_{1\varepsilon}$ and $\rho_{0\varepsilon} \neq 0$, then the model has selection bias. This implies the error term ε_{0i} or ε_{1i} is not equal to zero and OLS estimation is no longer consistent. According to Maddala [50] an ESR model can be efficiently estimated using maximum likelihood estimation as follows:

$$E(\varepsilon_{1i}/C_i = 1) = E(\sigma_{1\varepsilon}\varepsilon_i/\varepsilon_i \leq \alpha Z_i) = \alpha_{1\varepsilon} \frac{\phi(\alpha Z_i)}{\Phi(\alpha Z_i)} \quad (9)$$

$$E(\varepsilon_{0i}/C_i = 0) = E(\sigma_{0\varepsilon}\varepsilon_i/\varepsilon_i \leq \alpha Z_i) = \alpha_{0\varepsilon} \frac{\phi(\alpha Z_i)}{1-\Phi(\alpha Z_i)} \quad (10)$$

Where ϕ represent the standard normal probability density function, and Φ is the cumulative density function. The ratio of ϕ and Φ in equation (9) and (10) is the inverse Mills ratio. Therefore, the inverse mill ratio is written as:

$$\lambda_{1i} = \frac{\phi(\alpha Z_i)}{\Phi(\alpha Z_i)} \quad (11)$$

$$\lambda_{0i} = \frac{\phi(\alpha Z_i)}{1-\Phi(\alpha Z_i)} \quad (12)$$

Fitting equation (8) and (9) in equation (4) and (5) yields

$$y_{1i} = \beta_1 X_{1i} + \sigma_{1\varepsilon} \lambda_{1i} + v_{1i} \text{ if } C_i=1 \quad (13)$$

$$y_{0i} = \beta_0 X_{0i} + \sigma_{0\varepsilon} \lambda_{0i} + v_{0i} \text{ if } C_i=0 \quad (14)$$

Where v_{1i} and v_{0i} are the new error term with zero means. Freedman, et al. [55] used weighted least square to account for heteroskedastic errors in v_{1i} and v_{0i} .

Based on the estimated covariance $\rho_{1\varepsilon}$ and $\rho_{0\varepsilon}$, and the likelihood ratio test obtained from the Endogenous Switching regression model, we can assess if the ESR model is suitable for this study or not. If $\rho_{1\varepsilon}$ or $\rho_{0\varepsilon}$ are statistically significant, and the likelihood ratio test accepts the alternative hypothesis of endogenous, then the application of an endogenous switching model is necessary to address selection bias.

4. Findings and Discussion

4.1. Descriptive Statistics

The descriptive statistics of the data analyzed shows that 119 of the rural households has access to formal credit while 128 household had access to informal credit. About 52.63 percent of the household participants were male, while 47.37 were female. Table 1 reveals that 65.18 percent of the household participated in agricultural activities, while 34.83 percent participated in non-agricultural activities. Most of the farmers (92 percent) belong to the age group (20–49) while approximately 7 percent of the participants were found between 50–70 years old. Regarding extension service, approximately 27.52 percent received extension service, while majority of the household (72.47 percent) did not. The mean schooling years of the participants was approximately 14 years. On average, the household had approximately 12 years of farming experience. Approximately 47 percent of the household owned landed property while 52 percent rented land. Similarly on average, around 1.7 million CFA (Central African Franc) was spent annually on consumption expenditure.

Table 1.
Descriptive Statistics.

Variables	Freq	Percentage	Mean	Std. Dev	t-value
Credit Type					
Formal = 1	119	48.18			
Informal = 0	128	51.82			
Total =	247	100	.481	.500	15.123***
Occupation					
Agric = 1	161	65.18			
Non-Agric = 0	86	34.83			
Total =	247	100	.348	.477	11.463***
Gender					
Male = 1	130	52.63			
Female = 0	117	47.37			
Total =	247	100	.526	.500	16.533***
Age					
20–49 = 0	228	92.30			
50–70 = 1	19	7.69			
Total =	247	100	.514	.636	12.693***
Extension Service					
Yes = 1	68	27.52			
No = 0	179	72.47			
Total =	247	100	.275	.447	9.667***
Land Status					
Owned Land = 1	118	47.77			
Rent land = 0	129	52.23			
Total =	247	100	.477	.500	15.001***
Trade/farm experience			12.898	9.983	20.306***
Income earners			1.788	1.427	19.657***
Years of Schooling			14.222	3.987	56.062***
Consumption Expenditure			1777503	4268741	6.544***

Note: ***,denote significance at 1%, level of significance.

4.2. Probit Estimation on Credit Access

Before running the econometric models, the Variance Inflation Factor was used to check for multicollinearity problem among the explanatory variables. The results from the VIF test clearly indicate that the data has no serious problem of multicollinearity. The probit regression results pertaining to the likelihood of a household's obtaining credit are shown in table 2. The findings reveal that occupation positively and significantly affects household access to credit. This implies that households that undertake agricultural activities (such as crop farming and animal rearing) are more likely to access credit than those engaged in non-agricultural activities. Farming activities are the main income-generating activity in the study area. Moreso, the big cities of Douala, Yaoundé, and Baffoussam, which are just some few kilometers away, provide a market for the agricultural products which enables the farmers to generate income. In this regard, lenders are comfortable lending because they are more likely to repay their loan. This finding agrees with the findings of Kumar [51] who also found that households who are self-employed in agriculture are more likely to access credit. Income earners also positively and significantly influence household access to credit. This implies that households with members earning income are more likely to access credit. This is because, with such members earning income, the lender presumes that in case of loan default, there is a higher probability that these members in the family will repay the loan. This finding is consistent with [56]. Furthermore, the estimated coefficient of extension service is negative and statistically significant. This shows that households that access extension service have a greater tendency to access credit in the study area. The result implies that extension service increases the probability of awareness of the household on available credit facilities. This finding is in line with Dzadze, et al. [57] who found out that extension contract was the principal factor that influenced smallholder farmers' access to credit. Okurut [56]

Table 2.

Probit estimation on credit access.

Variables	Coef.	Marginal effect
Occupation	5.11** (.186)	.176**
Gender	-.081 (.174)	-.028
Age	-.245 (.161)	-.085
Extension Service	.425* (.201)	.146*
Land Status	-.091 (.203)	-.031
Farming experience	.005 (.009)	.001
Income earners	.185** (.078)	.064**
Years of Schooling	-.005 (.024)	-.001
Household Participants	-.061 (.041)	-.021
Constant	-.240* (.441)	
LR chi (9)	20.96	
Prob chi	0.0128	
Pseudo R	0.0658	
Likelihood	-148.729	

Note: ** and * denote significance at 5% and 10% level of significance.

The average treatment effect on the treated group (ATT) in terms of consumption expenditure on the treated group is 5.751 but on the control group is 5.767. The difference of ATT in terms of consumption expenditure between treated and control group is negative. This implies that the welfare condition of the household that accesses credit using formal finance will deteriorate. Also, the value of ATT of the treated group is less than that of the control group (ATT). This implies that access to informal credit finance has improved the welfare of the household in terms of consumption expenditure.

Table 3.

Estimate propensity score and match.

Variable	Sample	Treated	Controls	Differences	S. E.	T-stat
Consumption Expenditure	Unmatched	5.758	5.781	-.022	.085	-0.27

	ATT	5.751	5.767	-.015	.142	-.011
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The common support balancing test of the Propensity matching showed satisfactory results as 95.8 percent of the matched samples fell within the common support zone. The estimated propensity score in the region of common support falls between .13420 to .95837. Out of 247, 245 fall within “on support”, while only 2 falls within the off support. Furthermore, the ptest shows that all the variables used are insignificant. Considering the percentage bias, only two variables are above 5 percent.

Table 4.

Propensity Score matching with Common support.

Treatment assignment	Off Support	On support	Total
Untreated	0	160	160
Treated	2	85	87
Total	2	245	247

The matching overlap between those who access credit via formal and informal institution is presented in Table 4. The untreated path represents the distribution of those who had access to credit via the informal finance while the treated represents these household that had access to credit via the formal finance. The Figure (Figure 1) shows just a few of the samples are off support from the total sample. This result clearly shows a good match, indicating that the overlap assumption for matching both groups in the study was satisfied.

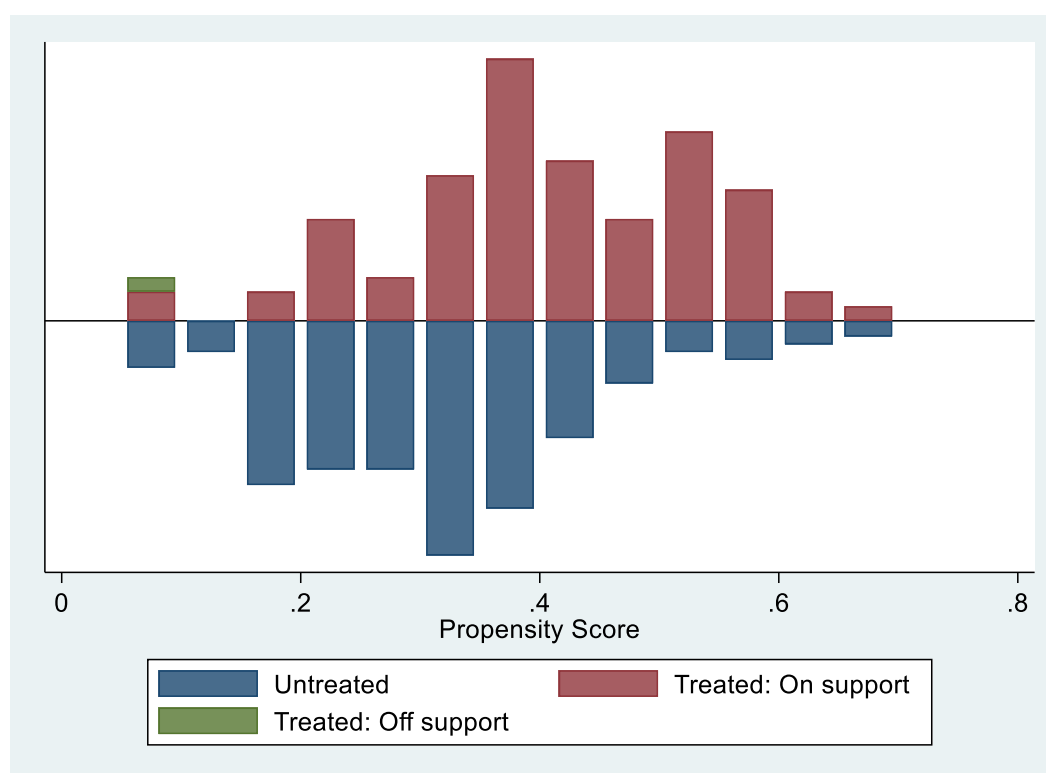


Figure 1.
Common support Balancing of Propensity Score.

Table 5 presents the matching quality test after the matching of covariates. The results indicate that there is a satisfactory balance after the match between those who access credit from formal and informal finance. From the analysis, the balance of covariates after matching can be verified by Pseudo R^2 ,

probability value and bias reduction. The Pseudo R^2 must be low to have balance covariates between treatment group and control group. In the study, the Pseudo R^2 value after matching is low (0.019) were as, before matching Pseudo R^2 was 0.066. Moreso, the mean bias before matching is 14.4% but after matching the mean bias has reduced to 6.1%.

Table 5.

Quality indicator after propensity score matching

Parameters	Before Matching	After Matching
Pseudo R^2	0.066	0.019
LR X^2	20.96	4.50
P-value ($P > X^2$)	0.013	0.875
Mean Standardized bias %	14.4	6.1
Med Bias	11.6	4.7
B	62.6	32.5
R	0.99	1.65

Figure 2. presents the sample's propensity score graphs. It shows that there is an overlap in the propensity score range between the treatment and control groups. The distribution of the covariates among the control and treatment groups was not homogeneous. However, after matching the propensity scores of the control and treated observations, the graph shows homogenous distributions of the propensity scores between the control and treated groups of the rural household farmers.

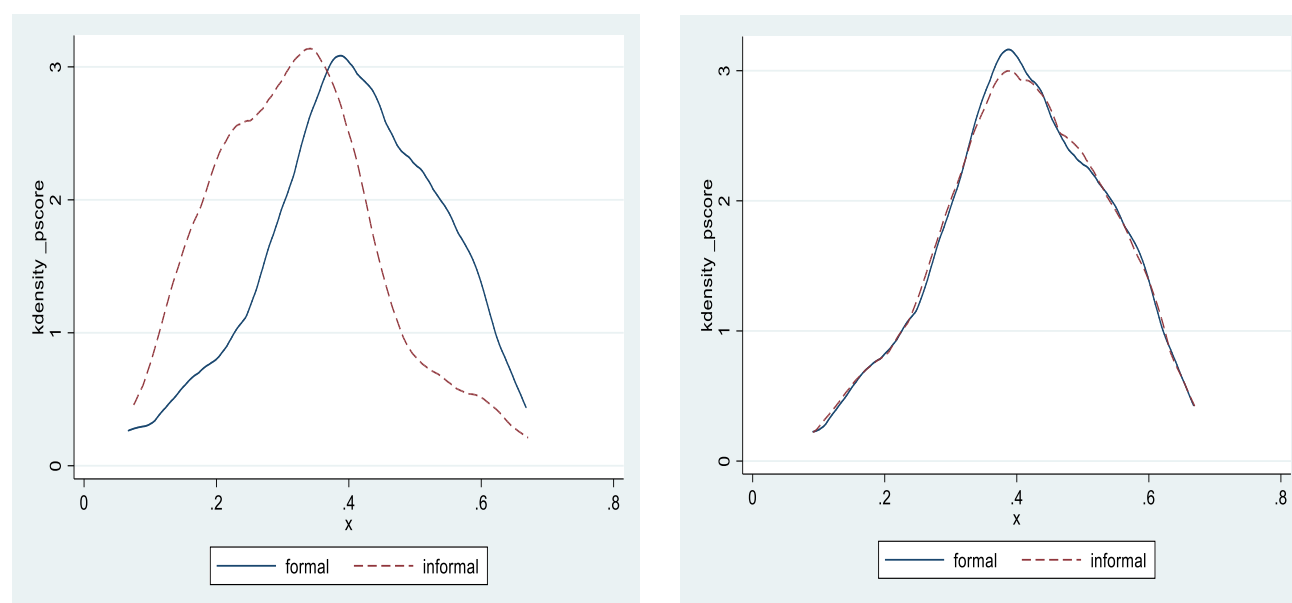


Figure 2.

Propensity score graph before and after matching.

The results of the average treatment effect on the treated from the propensity score matching estimation are presented in Table 6. A nearest neighbor algorithms was used. The result of this matching method was positive and statistically significant. For the effect of informal credit access on rural households' consumption expenditure, the Nearest Neighbor matching shows that the average treatment effect is 0.186. This means that household that receive credit from informal financial institution will have an improvement in their household consumption expenditure by 18 percent.

Table 6.

Propensity score matching based average treatment effects on household consumption expenditure.

Matching Algorithm	Treated	Control	ATT	S.E
Nearest Neighbor	86	61	0.000	.186*
Radius matching method	86	159	-0.059	0.091
Kernel Matching method	86	159	-0.038	0.125
Stratification method	86	159	-0.069	0.099

4.3. The Impact of Credit Access on Household Welfare

Table 7 presents findings obtained from the endogenous switching regression model. This study uses household expenditure as an indicator for household welfare. The choice of this proxy was recommended by Ravallion [58] and Coudouel, et al. [59]. The Wald test was used to confirm the significance of the regression and the constant term. The LR test is significant at 5%, which indicates that the endogenous switching regression model is a better choice than an exogenous model.

Table 7 shows the different factors affecting household welfare in the different regime. The correlation coefficients (ρ_1 and ρ_0) in the table capture the possible differences in household welfare for those that access credit from formal and informal finance. With formal credit finance, the value of ρ_1 is positive but statistically insignificant, while the value of ρ_0 is positive and statistically significant. This implies that, household that access credit from informal are better off in term of welfare than household that access credit through formal finance (see Table 8). Regarding credit access to informal finance, gender is found to be positive and statistically significant. This shows that male-headed households will have a greater increase in consumption expenditure, which implies the level of welfare is likely to be high. This is consistent with the findings of Hossain, et al. [23] who found out that the odd of being poor is about 40% lower for male-led household than for female-led household.

As expected, the coefficient for years of schooling for household that access credit using formal and informal finance is positive and statistically significant. This supports the argument that, additional years of schooling would increase household income. Also, additional years of schooling can give access to better paid jobs and increase the income and welfare of the household, as previously suggested by Van Vu [60]. Regarding the role of extension service, the finding shows that, extension service is positive and statistically significant. Our finding is in line with previous findings in some developing countries where the provision of agricultural extension service is a pro-poor mechanism that promotes rural households' welfare [61]. Further, we found out that members in the household that earn income, have a positive and significant effect on rural household welfare. This implies that family members that have jobs would assist the household with income to improve their living standard. This finding is in line with a study carried out in Nepal which shows that household member in the age group of 15-20 years' work actively to assist the family financially [62].

For household that access credit with formal finance, farming experience is positive and statistically significant. This shows that experience in farming enable farmers to produce better yields which improve their income and subsequently their welfare. This tallies with Oke, et al. [63].

The estimation of Average Treatment Effect (ATE) on table 8 reveals that the treatment effect of informal finance instructions on household welfare is positive and significant. The ATE is 5.790 if the household receive credit from informal financial institution. While for those who receive credit from formal financial institution, their ATE would be 0.520.

Table 7.
Findings from Endogenous Switching Model.

Variables	Endogenous Switching Model	
	Access to Credit (Informal finance)	Access to Credit (Formal finance)
Occupation	0.086 (0.107)	-0.110 (0.168)
Gender	0.159 (0.092)*	0.152 (0.119)
Age	0.271 (0.215)	0.182 (0.153)
Extension Service	0.227 (0.100)**	-0.261 (0.187)
Land status	0.035 (0.105)	0.120 (0.145)
Farming experience	0.004 (0.005)	0.019 (0.006)**
Number of Income earner	0.192 (0.040)***	0.109 (0.066)
Years of Schooling	0.032 (0.012)**	0.051 (0.015)**
Household participants	0.011 (0.021)	0.039 (0.033)
Constant	5.092 (0.230)***	4.351 (0.393)***
$\sigma_{1\varepsilon}$	0.514	(0.039)***
$\sigma_{0\varepsilon}$	0.615	(0.054)***
ρ_1	0.007	(0.615)
ρ_0	0.828	(0.086)***
Wald test	59.33***	
LR test	chi ² =4.86**	
Log likelihood	-326.745	

Note: ***, **and *, denote significance at 1%, 5% and 10% level of significance.

Table 8.
Endogenous Treatment effect estimation.

Average Treatment Effect (ATE)	Coefficient	Robust Std. Err
Formal Finance	0.520	1.515
Informal Finance	5.790	0.687***

Note: ***, denote significance at 1% level of significance.

5. Conclusion and Implication

This study examined the differential impact of formal and informal finance on rural household welfare in the North-West region of Cameroon. Formal and informal credit finance coexist in rural Cameroon without clear evidence of one superseding the other. Recognizing the limited knowledge about the functioning of rural credit markets in Cameroon, especially on rural household welfare, this study specifies two methods, that is Propensity Score Matching and an Endogenous Switching Regression technique to compare access of formal and informal credit finance on rural household consumption expenditure. The ERS model was deemed an appropriate econometric model as it addresses the problem of endogeneity and sample selectivity bias. From our findings, household access to credit is significantly determined by occupation, extension service and household income earners.

Consumption expenditure was used as an indicator to measure household welfare, using PSM technique, this study found that informal credit finance has impact on household welfare via consumption expenditure. The findings showed that, the ATT on the treatment group in terms of

consumption expenditure is less than the control group. This implies that the role of formal credit finance did not improve the welfare of the rural household as compared to informal rural finance. This may be due to the fact that there are a lot of transaction cost involve with formal credit finance. In order to obtain loan from a formal finance in Cameroon, the household head faces the following challenges; collateral security (mostly a landed property or a house), high interest rate, information asymmetry [64]. These challenges are known to hinder their access to formal credit thereby limiting their ability to improve their welfare.

Regarding household that access credit via informal finance, gender, extension service, number of income earners and years of schooling significantly influence rural household welfare.

Transparency:

The authors confirm that the manuscript is an honest, accurate, and transparent account of the study; that no vital features of the study have been omitted; and that any discrepancies from the study as planned have been explained. This study followed all ethical practices during writing.

Author Contributions:

Louis Atamja (L.A) contributed to the research design and data analysis. Sungjoon Yoo (S.Y) contributed in writing and supervising the research. Dongjoo Lee (D.L) contributed to the formal analysis All authors have read and agreed to the published version of the manuscript.

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