# IMPACT OF ACCESS TO CREDIT ON FARM INCOME: POLICY IMPLICATIONS FOR RURAL AGRICULTURAL DEVELOPMENT IN LESOTHO

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**Abstract**

In this era of rapidly increasing food demand, a sustainable food supply is required to meet such demand. This suggests that capital investment through adequate access to credit is needed to develop the agricultural sector in developing countries including Lesotho. Therefore, this paper examined farmers' access to credit and its impact on farm income using a three-stage model, namely: Probit, Tobit, and propensity score matching. The study was conducted in Lesotho with a sample size of 100 farmers. The empirical results reveal that access to credit increases net farm revenues by US $116.608 to US $136.894. Furthermore, savings, scale of production, membership of farmer association and financial record keeping exert significant positive effects on access to credit, while higher interest rate reduces farmers' likelihood of securing credit from a financial institution. We conclude that adequate access to credit is necessary to promote a sustainable agricultural development and the livelihoods of rural farmers in Africa.

**Keywords:** Credit, agricultural development, Lesotho, credit, propensity score matching, Probit

## 1. Introduction

Agricultural development is considered as the foundation of industrial development and, consequently, of a country's overall economic development. Agricultural credit is one of the most important factors that has facilitated agricultural development in many developing and developed countries (Meijerink & Roza, 2007). The economies of most developing countries depend on agriculture. Thus, credit is regarded as a major component of agricultural and rural development programmes and also considered as an important instrument in helping small-scale farmers and micro-entrepreneurs to increase their incomes. Numerous programmes have been established to increase the volume of credit to serve this purpose. Governments design loan programmes to give credit support to farmers for policy-favoured operations, such as the mechanisation of farm operations. They also assist agricultural credit institutions and agricultural banks to provide farmers with easy access to ordinary credit to finance their capital needs in production, consumption and investment. Agricultural finance policy therefore is vital in terms of providing adequate credit to support agricultural production in particular, and policy-oriented agricultural development in general (World Bank, 2005).

Advocates of credit as a poverty-alleviation measure (e.g. Adams, 1979) contend that limited availability of credit services has undermined rural micro-enterprise activities due to a lack of capital for investment and has prevented farmers from adopting improved farming practices because of their inability to purchase the necessary inputs required for agricultural production. Low productivity in agriculture is generally attributed to the use of poor technology resulting from limited access to credit. Moreover, it is perceived that the unavailability of credit facilities has to a large extent discouraged the entry of youth into the farming sector, and renders most of them unemployed because of a lack of investment capital and incentive. This then raises the following pertinent research questions: Why do farmers have low access to microfinance? What factors determine the amount of credit received by farmers? What is the impact of microfinance on farmers' total farm income? The main objective of this study is to estimate the effect of farmers' access to credit on their farm incomes in Lesotho. The study also analyses the factors that influence farmers' access to credit and the amount of credit obtained.

This current study is relevant, particularly at this moment that most developing countries including Lesotho are developing their agricultural sector. As would be elaborated in details in Section 2, the agricultural sector plays significant roles in the economic development of Lesotho. The agricultural sector provides numerous employment opportunities for many people in Lesotho. It also contributes to alleviation of poverty and food insecurity in the country. However, agricultural financial is important in transforming agricultural sector of Lesotho. Credit is required to purchase productive inputs such as high yield planting materials, adoption of improved farm technology, farm implements, and rent arable land. This therefore justifies the need to conduct a study on the determinants of farmers' access to credit in Lesotho and further evaluate how access to credit affect farm incomes.

Moreover, there is existence of ample empirical literature on farmers' access to microfinance have been conducted in many developing countries (Foltz, 2004; Nuryartono, Zeller, & Schwarze, 2005; Subbotin, 2005; Eze, Ibekwe, & Korie, 2009; Sidibé, Vellema, Dembélé, Témé, Yossi, Traoré & Kuyper 2014; Motsoari, Cloete, & Van Schalkwyk, 2015). Most of these empirical studies analyse

factors that influence farmers' access to credit. The common factors are farmer age, farm income, non-farm income, financial assets (savings), remittances and pension, farm size, family labour, land ownership, credit awareness, gender, education level and repayment ability. Although some empirical studies have been conducted on impact of credit access on farm productivity and incomes (Hazarika & Alwang, 2003; Foltz, 2004; Petrick, 2004; Mohsin, Ahmad & Anwar, 2011; Obilor, 2013; Awotide et al. 2015) in some developing countries, there is however a dearth of literature on farmers' access to credit and its impact on farm incomes in Lesotho. Recently, Motsoari et al. (2015) examined the determinants of farmers' access to credit but the study did not estimate the impact of credit access on farmers' farm income. Our study contributes this narrowing this relevant knowledge gap by quantifying the effect of credit access on farm incomes in Lesotho. The study employs the double-hurdle approach (Probit and Tobit models) and the propensity score-matching method in the empirical estimation. The findings from the study would be beneficial to advise policy makers on promoting adequate access to credit and how this can enhance sustainable rural development in Southern African countries including Lesotho.

The rest of the article is organised as follows. An overview of the agricultural and financial sectors in Lesotho is presented in Section 2. The methodology employed to address the stated research questions is explained in Section 3. The key empirical findings of the research are delineated in Section 4, while the last section concludes and provides policy recommendations.

## 2. Overview of the agricultural and financial sector in Lesotho

### 2.1. The agricultural sector of Lesotho

In 2017, the agricultural sector contributed 5.7% to the gross domestic product (GDP) of Lesotho (The World Bank, 2017). Despite the declining performance of the agricultural sector, it continues to be the major source of employment and sustenance for majority of the rural population in Lesotho. It is a major source of economy growth of the country. The agricultural products produced in Lesotho include wheat, corn, sorghum, pulses, livestock, and barley. Most of the livestock are raised for household consumption and the animals include cattle, sheep, and goat. These livestock produce milk, meat, good quality wool and mohair. The bulk of crops and livestock are produced in small villages which are located from the main roadways. The agricultural sector is characterised by small-scale production. About 90 percent of the farmers are smallholders with a few medium and large-scale farms (Motsoari et al., 2015). The major constrains that hamper agricultural development in Lesotho include low investment (due to inadequate access to agricultural finance), over-reliance on traditional production methods, and climate change (African Development Bank Group, 2013).

### 2.2. The financial sector in Lesotho

The financial sector in Lesotho is characterised by a formal financial sector, the absence of a sizable microfinance sector, and a very strong informal financial sector. The formal financial sector is regulated and supervised by the Central Bank of Lesotho (CBL). Lesotho's financial system has a regulatory and supervisory regime for banks and financial institutions such as insurance companies and micro-finance credit institutions, cooperative banks and moneylenders that is consistent with international standards. Lesotho's banking centre is concentrated in the capital Maseru, where there are four banking institutions: the government-owned Lesotho Post Bank and three subsidiaries of South African Banks – Standard Lesotho Bank, First National Bank and

Nedbank. Together, these banks have 42 branches across the country. Non-banking financial services in Lesotho comprise eight registered insurance companies, seven credit-only microfinancing institutions, and a large number of registered and unregistered money lenders. The supportive regulatory framework includes the Financial Institutions Act of 2012, which provides a broad framework for the regulation, registration and supervision of both banking and non-banking financial institutions, excluding insurance and cooperatives, and a credit bureau established in 2013. A systematic national identification system has also been introduced to complement the security and sustainability of the free forms in the financial sector (World Bank, 2004). The informal sector, on the other hand, is quite varied and comprises burial societies, which principally cover burial expenses and grant loans from their excess liquidity; rotating savings and credit associations (ROSCAS); non-rotating, accumulative savings and credit associations and pyramid schemes; and apparently a large number of unlicensed moneylenders in both rural and urban areas.

The CBL is concerned about the low levels of competition in the country and wishes to encourage more competition. One of the concerns of the CBL is the low level of lending within the country. The causes of these low levels are complex. First, the fully fledged commercial banks are subsidiaries of foreign banks, and their main business is to provide financial services to companies operating in both South Africa and Lesotho. Second, the political events in 1998 disrupted the banks' confidence in the stability of the country, and it took them a long time to gain confidence in the prevailing situation. Third, the repayment culture of the Basotho is not very pronounced, and many individuals and companies have borrowed from parastatal credit institutions and the Lesotho Bank without being forced to pay back their loans. The fourth cause is probably the most critical, i.e. the absence of a functional commercial court with accelerated proceedings and the rapid execution of court decision against debtors. The gravest concern of the CBL is the absence of suitable legislation related to non-bank financial institutions, and the concomitant human and financial resources to supervise non-bank financial institutions and enforce decisions and compliance (Finmark Trust, 2003). The current legislation pertaining to credit unions is inadequate, as it permits the mobilisation of deposits from the general public without any prudential regulations and without any form of control. Credit unions are not even audited regularly. The regulations pertaining to moneylenders are outdated and do not impose even the slightest prudential management. In addition, the ceiling on interest rate levels is not enforced at all, reporting is not checked, and the data reported by is not analysed due to a lack of manpower. Furthermore, there is no legislation pertaining to microfinance institutions, which have partially filled the gap left by the commercial banks and the informal sector in many African countries. The absence of regulations controlling pyramid and investment schemes, which have grown exponentially in the past years, is also of great concern to the CBL and policy makers (World Bank, 2004). Lesotho does not have a capital market. Recently, unit trusts were introduced under the Collective Investments Act of 2001. As there is no stock exchange, unit trusts function more as venture capital funds, investing directly in companies. Government securities are traded through the CBL. The lack of effective long-term capital markets contributes to the inability of banks to engage more in term lending and there is no deposit insurance facility in Lesotho (World Bank, 2004).

## 3. Methodology

### 3.1. Theoretical framework

The farmer's access to credit is dichotomous, involving two mutually exclusive alternatives. The individual either has access to microfinance or not. The concept for such analysis is founded on the threshold theory of decision making, in which a reaction occurs only after the strength of a stimulus increases beyond the individual reaction threshold (Smith & Blundell, 1986). The study assumes that the farmer decides to access credit or not by considering the net benefit ($U_{AM}$) derived from the access to credit. The farmer is more likely to access credit if the expected net benefit derived from accessing credit ($U_{AM}$) is greater than from not accessing ($U_{NM}$), which can be expressed as $U_{AM} > U_{NM}$. This suggests that, when faced with a choice, every individual has a reaction threshold influenced by several factors, including socioeconomic and institutional characteristics related to him/her, as well as the requirements made by the microfinance institutions. Theoretically, the probit model to determine a farmer's access to microfinance can be modelled as stated in (1):

$$Credit_i = \begin{cases} credit_i^* = W_{ij}\varphi_j + \xi_i, \text{ if } credit_i^* > 0 \\ 0, \qquad \text{otherwise} \end{cases} \tag{1}$$

where $Credit_i$ denotes the farmer's access to credit, $credit^*$ denotes a latent dependent variable, $W_{ij}$ denotes a (1 x K) vector of the socioeconomic characteristics of the respondent, $\varphi_j$ is (K x 1) and denotes the unknown parameter, and $\xi_i$ denotes the error term. Taking the first partial derivatives of equation (1) with respect to $W_{ij}$ gives the respective marginal effects. The marginal effects indicate the effect of a unit change in each independent variable on the dependent variable in this study. The marginal effects are expressed as in equation (2):

$$\frac{\partial \Pr(Credit_i = 1 | W_{ij})}{\partial W_{ij}} = \frac{\partial E(Credit_i | W_{ij})}{\partial W_{ij}} = \Omega(\mathbf{W}'\varphi)\varphi \tag{2}$$

The probability of a farmer to access credit can be represented as:

$$\Pr(Credit_i = 1) = \Pr(credit_i^* > 0) = \Pr(\xi_i > -\phi W_{ij}) = 1 - \Omega(-\varphi W_{ij}) \tag{3}$$

where $\Omega$ is the cumulative distribution function for $\xi_i$.

The study further investigates the determinants of the amount of credit received by farmers. A Tobit regression model is employed, since some farmers may receive a certain amount and others not. Thus, the dependent variable (amount of credit) becomes censored, with the lower bound being zero and the upper bound being the maximum amount of the loan obtained. The Tobit model is expressed as indicated in (4):

$$amount_i^* = \alpha + X_i\delta + \varepsilon_i, \quad i = 1, 2, ..., N \tag{4}$$

where $amount_i^*$ is a latent response variable, $\delta$ is the unknown parameter to be estimated, $X_i$ is an observed (1 x *k*) vector of explanatory variables and $\varepsilon_i \sim i.i.d.\ N(0, \sigma^2)$. Instead of observing $amount_i^*$, we observe $Amount_i$ which is mathematically specified as:

$$Amount_i = \begin{cases} amount_i^*, & \text{if } amount_i^* > 0 \\ 0, & \text{if } amount_i^* \leq 0 \end{cases} \tag{5}$$

where $Amount_i$ is the amount of credit received by *i*, the farmer.

### 3.2. Evaluating the impact of credit access on total farm income

In addition to examining the access to credit and amount of loan given, it is also critical to determine whether there is a significant difference in farm incomes between farmers who have access to credit and those who do not. Using the standard t-test to make this comparison may not give a true reflection due to selection bias. One of the ways to address this is to use the before and after receiving credit approach. Implementing this approach may be difficult owing to the unavailability of panel data. By using cross-sectional data, one may confront the issue of counterfactual effect. Rosenbaum and Rubin (1983) suggest that propensity score matching PSM, a non-parametric approach, is the appropriate method to estimate the counterfactual effect. Counterfactual effect simply implies comparing the outcome of the treated observations with the outcome of non-treated observations, the outcome of the treated observations if they were not treated comes from the paired observations which are not treated, in this case, farmers who do not receive credit (Rosenbaum and Rubin, 1983). Treated observations are the farmers who have received credit, while the control or untreated observations are those farmers who have not received credit. Propensity score matching is the pairing of treatment and control observations with similar values for the propensity scores and possibly other covariates, and the removing of all unmatched units (Rubin, 2001). It is first specified by estimating the average treatment effect. Rosenbaum and Rubin (1983) define the average treatment effect ( $\Delta_i$ ) in a counterfactual framework as:

$$\Delta_i = Income_{CA} - Income_{NCA} \tag{6}$$

where $Income_{CA}$ and $Income_{NCA}$ denote total farm, income obtained by farmers who have access to credit and that of those who do not have access, respectively. In estimating the impact from equation (6), a problem that arises is due to the fact that either $Income_{CA}$ or $Income_{NCA}$ is normally observed, but not both of them for each farmer. What is usually observed can be specified as:

$$Income_i = D_i(Income_{CA}) + (1 - D_i)Income_{NCA} \quad D = 0,1 \tag{7}$$

Denoting *PR* as the probability of observing a farmer with D = 1, the average treatment effect, ATE, can be specified as:

$$ATE = \Pr[E(Income_{CA} \mid D=1) - E(Income_{NCA} \mid D=1)] + (1-\Pr)[E(Income_{NCA} \mid D=0) - E(Income_{NCA} \mid D=0)] \quad (8)$$

The main issue with equation (8) is the problem of casual inference that comes from the unobserved counterfactuals $E(Income_{CA} \mid D=0)$ and $E(Income_{NCA} \mid D=0)$. As pointed out by Smith and Todd (2005), these unobserved counterfactuals cannot be estimated. The counterfactual problem can be addressed with the propensity score-matching method, which summarises the pre-treatment characteristics of each subject into a single index variable and then uses the propensity scores to match similar individuals (Rosenbaum & Rubin, 1983). The PSM, which defines the probability of assignment to treatment conditional on pre-treatment variables, is expressed as:

$$p(X) = \Pr[D=1 \mid X] = E[D \mid X]; \; p(X) = \Phi\{f(X_i)\} \quad (9)$$

where $\Phi\{.\}$ can be a normal or logistic cumulative distribution and $X$ is a vector of pre-treatment characteristics. Estimating the treatment effects based on the propensity score requires two assumptions. The first is the conditional-independence assumption (CIA), which requires that the common variables that affect treatment assignment and treatment-specific outcomes be observable. The dependence between treatment assignment and treatment-specific outcomes can be removed by conditioning on these observable variables. A second condition is that the average treatment effect on the treated (ATT) is only defined within the region of common support. This assumption ensures that persons with the same $X$ values have a positive probability of being both participants and nonparticipants (Heckman, Ichimura & Todd, 1997). Once the propensity is computed, the ATT effect can be then estimated as:

$$ATT = E\{Income_{CA} - Income_{NCA} \mid D=1\} \quad (10)$$

$$ATT = E[E\{Income_{CA} - Income_{NCA} \mid D=1, p(X)\}] \quad (11)$$

$$ATT = E[E\{Income_{CA} \mid D=1, p(X)\} - E\{Income_{NCA} \mid D=0, p(X)\} \mid D=1] \quad (12)$$

A number of methods have been suggested in the literature to match similar participants and non-participants. The most commonly used approaches are the nearest neighbour matching (NNM), Kernel-based matching (KBM) and radius methods.

***Statement of Hypothesis*:** We postulate the following hypothesis.

$H_0$: The mean difference of net farm incomes of farmers who access credit and those who do not is not statistically differently from zero; thus, $Income_{CA} - Income_{NCA} = 0$

$H_1$: The mean difference of net farm incomes of farmers who access credit and those who do not is statistically greater than zero, thus $Income_{CA} - Income_{NCA} > 0$.

This hypothesis would be tested with the ATT estimates from the PSM using the standard t-test.

### 3.3. Empirical model specification

The empirical probit model to determine farmers' access to credit can be specified empirically as:

$$\begin{aligned} Credit_i = {} & \Phi_0 + \Phi_1 Region\_dummy_i + \Phi_2 Gender_i + \Phi_3 Age_i + \Phi_4 Education_i + \Phi_5 Arithm_i \\ & + \Phi_6 Farmz2_i + \Phi_7 Farmz3_i + \Phi_8 Extension_i + \Phi_9 FBO_i + \Phi_{10} Frecord_i \\ & + \Phi_{11} Saving_i + \Phi_{12} Interest_i + \xi_i \end{aligned} \quad (13)$$

where $Credit_i$ represents farmers' access to credit from the formal sector, such as banks and other microfinance institutions (1 if the farmer has access to credit and 0 otherwise); $Region\_dummy_i$ denotes location of farmer (1 if the farmer is located in lowland and 0 otherwise); $Gender_i$ denotes 1 if the farmer is female and 0 otherwise; *Age* denotes age of the farmer in years and it was measured as a categorical variable (1 = 20-30 years, 2 = 31-40 years; 3 = 41-50 years, and 4 = above 50 years); *Education* indicates number of years of formal schooling; $Arithm_i$ is used as a proxy for farmers' ability to perform basic arithmetic (1 if the farmer responses that he/she has a good arithmetic ability and 0 otherwise); $Extension_i$ denotes farmer's access to extension services (1 if the farmer has access to extension services and 0 otherwise); $FBO_i$ represent farmer-based organisation, 1 if the farmer is a member of any farmer-based organisation and 0 other; $Farmsize2_i$ equals 1 if the farmer operates on a medium-scale (5 to 10 ha) and 0 otherwise; $Farmsize3_i$ equals 1 if the farmer operates on a large-scale (> 10 ha) and 0 otherwise; $Farmsize1_i$ is used to represent the farmer operating on small-scale (< 5 ha) and is used as a base category; $Frecord_i$ denotes financial record keeping (1 if the farmer keeps financial records and 0 otherwise); $Saving_i$ denotes savings (1 if the farmer saves part of his income with any financial institution and 0 otherwise); and $Interest_i$ is the interest rate in percentage. $\Phi_0$ is the constant term and $\Phi_1,...,\Phi_{12}$ are the coefficients of the respective explanatory variables. The parameters ($\Phi_0,...,\Phi_{12}$) in the model are estimated with the maximum likelihood approach.

The study further analyses the determinants of amount of loan by farmers. The analysis is performed using the Tobit regression model which is empirically specified as:

$$\begin{aligned} Amount_i = {} & \delta_0 + \delta_1 Region\_dummy_i + \delta_2 Gender_i + \delta_3 Age_i + \delta_4 Education_i + \delta_5 Arithm_i \\ & + \delta_6 Farmz2_i + \delta_7 Farmz3_i + \delta_8 Extension_i + \delta_9 FBO_i + \delta_{10} Frecord_i \\ & + \delta_{11} Saving_i + \delta_{12} Interest_i + \delta_{13} Repayment_i + \xi_i \end{aligned} \quad (14)$$

where $Amount_i$ is the amount of loan obtained by farmers from the financial institution (in Rand), and $Repayment_i$ is the loan repayment record (1 if farmer has a good loan repayment record and 0 otherwise). The researchers did not obtain loan repayment history from farmers' financial institutions but rather they solicited the piece of information from the farmers. All the other variables have been defined already in equation (13). $\delta_0$ is the constant term and $\delta_1,...,\delta_{13}$ are the coefficients of the respective explanatory variables. The parameters ($\delta_0,...,\delta_{13}$) in the model are estimated with the maximum likelihood approach. A summary of the description of the variables included in the probit and Tobit regression models, together with their expected signs and mean and standard deviations are provided in Table 1.

Table 1. Summary description of variables included in the models

| Variable | Description | Mean | SD | Expected sign | |
|---|---|---|---|---|---|
| **Dependent** | | | | Probit | Tobit |
| Access to credit | 1 if farmer has access to credit and 0 otherwise | 0.27 | 0.45 | | |
| Amount of credit | The amount of the loan obtained by farmers from the microfinance institutions (in Rand) | 23,572.56 | 71,444.77 | | |
| **Explanatory** | | | | | |
| Region-dummy | 1 if farmer is located in lowland and 0 otherwise | 0.60 | 0.49 | + | + |
| Gender | 1 if farmer is female and 0 otherwise | 0.46 | 0.50 | + | + |
| Age | Age of farmer (1 = 20-30 years, 2 = 31-40 years; 3 = 41-50 years, and 4 = above 50 years) | 2.49 | 0.72 | - | - |
| Arithm | 1 if farmer's arithmetic ability is good and 0 otherwise | 0.44 | 0.50 | - | - |
| Education | Educational level (0 = no formal education, 1 = primary, 2 = secondary, 3 = tertiary) | 1.91 | 1.30 | + | + |
| Extension | 1 if farmer has access to extension services and 0 otherwise | 0.90 | 0.30 | + | + |
| FBO | 1 farmer-based organisation | 0.84 | 0.368 | + | + |
| Farmsize2 | 1 if farmer operates on medium-scale (5 to 10 ha) | 0.13 | 0.34 | + | + |
| Farmsize3 | 1 if farmer operates on large - scale (5 to 10 ha) | 0.24 | 0.43 | + | + |
| Record | 1 if farmer keeps financial records and 0 otherwise | 0.60 | 0.49 | + | + |
| Saving | 1 if farmer saves with any financial institution and 0 otherwise | 0.63 | 0.49 | + | + |
| Interest | Interest rate in percentage | 21.72 | 7.105 | + | + |
| Repayment | 1 if farmer has a good repayment record and 0 otherwise | 0.18 | 0.39 | + | + |

### 3.4. Source of data

The study was conducted in Lesotho, which is located in southern Africa. Lesotho is demarcated into distinct livelihood zones, namely: Lowlands, Foothills, Senqu River Valley and Highlands (also known as Mountains). The Lowlands are further divided into the Northern and Southern

parts. Each of these zones is characterised by types and levels of availability of resources, as well as agro-climatological and ecological conditions. Livelihood patterns clearly vary from one area to another according to local factors such as climate, soil and access to markets. Where a community lives is one factor determining its options for obtaining food and generating income. The Livelihood Zones in Lesotho more or less coincide with the agro-ecological regions. The country is divided into 10 administrative districts, which differ in terms of size, topography, climate and stages of development, and across which the livelihood zones can be overlaid (FAO/WFP, 2005). It is further subdivided into two types of residential areas, namely: urban and rural. Cutting across all the livelihood zones is the importance of environmental resources, such as water, soil, range and forestry, which support both human and livestock requirements.

Data for this study was collected from the two largest agro-ecological zones of Lesotho, namely: the Lowlands and the Highlands. The Northern lowlands cover approximately 474 535 ha of land and it is the most productive arable land in the country that has generally good annual rainfall ranging from 700 mm to 800 mm. The area is estimated to support 430 658 people. Up to 43% of the population in this area is deemed poor (Department of Meteorology, 2008). The population in this area derives its livelihood from the production of field crops, cash crops, paid employment and trade. Crops and livestock sales form an important source of cash income. The Southern Lowlands cover approximately 253 148 ha and are generally hotter and drier with annual precipitation ranging from 600 mm to 700 mm per annum. This zone supports approximately 597 175 people. The four main sources of livelihood in this zone are food crops, paid employment, livestock and trade. Up to 53% of the population is estimated to be poor (Department of Meteorology, 2008). During times of drought, pastoralists barter their livestock for food cereals to supplement their food requirements. The highlands is the least densely settled part of the country and communities in this area tend to be more isolated from services and markets. This zone supports approximately 385 991 people. Livelihoods in this area are dependent on field crops and livestock. Up to 55% of the population is poor. People in this area are mostly pastoralists. During years of drought, they exchange livestock for food cereals to supplement their food requirements (Department of Meteorology, 2008).

Cross-sectional data obtained from a sample of 100 farmers in the study area was used in this study. The data was collected by means of personal interviews in a sample survey conducted in 2008 among the farmer population of the two largest agro-ecological zones in Lesotho – the Lowlands (both northern and southern) and the Highlands regions. A random sample of districts in the regions was drawn to select representative districts in each region. Leribe, Mafeteng and Berea districts represented the Lowlands, while the Mohale's Hoek and Thaba-Tseka districts represented the Highlands region. Stratified random sampling was employed to select borrowers and non-borrowers for the study, and this entailed dividing the whole farmer population into mutually exclusive strata, and then randomly selecting units from each stratum. Random sampling was applied within each stratum, as it often improves the representativeness of the sample by reducing the sampling error. A random sample of villages appropriate for the study was identified in collaboration with the extension workers from each of the five districts, and lists of potential farm households were drawn up with the help of the relevant district agricultural offices.

A sample of 10 villages, representing about 30% of the villages, was drawn from 33 villages covering the selected agricultural resource centres. A stratified random sampling procedure was

employed to select borrowers and non-borrowers and to ensure representation of all the sub-centres. About 10% of small-scale farming households within each of the five villages were randomly selected for the household survey, making a sample of 100 respondents. Due to the time-consuming nature of the study and limited resources, the number of farm households targeted in the study was 130, but only 100 were interviewed and, of the 100 households sampled, 32 were borrowers and 68 were non-borrowers.

## 4. Results and discussion

### 4.1. Descriptive results

Farmers' access to loans and the sources of the loan are provided in Table 2. The table shows that the majority (68%) of the farmers did not borrow from any financial institutions, while only 32% accessed loans. This demonstrates that there is low access to loans by farmers in Lesotho. The low access to loans can affect agricultural development, for the transformation of the agricultural sector may require capital investment to procure farm inputs include labour and agro-inputs. Among the borrowers, the majority (53%) sourced loan from the Ministry of Agriculture of Lesotho, with an interest rate of 15% subsidised by the Government of Lesotho. The subsidy is mainly production subsidy (Standard Lesotho Bank, 2008). Twenty-five percent (25%) borrowed from banks at an interest rate of 16%, while 22% obtained loans from farmers' associations, with a very high interest rate of 30%. The average size of the loans was M56 125.12 (US $4 622.776), with a minimum and maximum of M500 (US $41.183) and M480 000 (US $39 535.458), respectively. The standard deviation of M71 444.77 (US $5 884.587) demonstrates a high variability in the size of the loans obtained by farmers.

Table 2. Access to loans and sources of loans

| Variable | Category | Frequency | Percent (%) | Interest rate |
|---|---|---|---|---|
| Access to credit | Yes | 32 | 32 | |
| | No | 68 | 68 | |
| Source of credit | Banks | 8 | 25 | 16 |
| | Ministry of Agriculture | 17 | 53 | 15 |
| | Farmers' associations | 7 | 22 | 30 |
| Amount of loan (R) | Mean | 56 125.15 | | |
| | Minimum | 500 | | |
| | Maximum | 480 000 | | |
| | Standard deviation | 71 444.77 | | |

Note: US $1 = M12.141[1]. Source: Authors' computations

Table 3 presents the reasons that farmers gave for not obtaining loans. The results show that 37% of the farmers who did not borrow mentioned that they preferred to use their own funds rather than borrowing from the financial institutions. Twenty-four percent (24%) feared that their loan application would be rejected. This fear might come from their inability to provide the necessary requirements to secure the loan. The high interest rate was one of the reasons given by 18% for not borrowing. The interest rates range from 15% to 30%, which are very high and deters farmers

[1] The official currency of Lesotho is Lesotho Maloti (M)

from accessing loans. The farmers find it difficult to repay loan with high interest rates. Fifteen percent (15%) stated that they did not access loans because they did not belong to any credit association. Farmers form credit associations to enable them to secure loans from financial institutions more easily. Lastly, a few farmers (6%) indicated that loan facilities were not available in their areas. The conclusion is that most of these farmers are highly risk averse.

Table 3. Reasons for not accessing credit

| Reason | Frequency | Percent (%) |
|---|---|---|
| Prefer to use own funds | 25 | 37 |
| Fear of rejection of loan application | 16 | 24 |
| High interest rate | 12 | 18 |
| Not a member of any credit association | 10 | 15 |
| Loan facilities do not exist in my area | 5 | 6 |

Source: Authors' computations

### 4.2 Econometric results

One of the assumptions made regarding the explanatory variables is that they do not correlate with each other. The violation of this assumption creates a multicollinearity problem, which results in incorrect signs and magnitudes of regression coefficient estimates. This may lead to inaccurate conclusions regarding the relationship between dependent and explanatory variables. A multicollinearity test was performed, specifically using the variance inflation factor (VIF). The results of the multicollinearity test are shown in Table 4.

Table 4. Diagnostic check for multicollinearity and heteroscedasticity

| Variable | VIF | Tolerance |
|---|---|---|
| ***Multicollinearity test*** | | |
| INTEREST | 1.5 | 0.6644 |
| SAVINGS | 1.48 | 0.6764 |
| FARM3 | 1.47 | 0.6790 |
| REPAYMENT | 1.41 | 0.7107 |
| EDUCATION | 1.4 | 0.7127 |
| FRECORD | 1.34 | 0.7466 |
| ARITHMET2 | 1.26 | 0.7912 |
| REGION | 1.21 | 0.8251 |
| FARM2 | 1.2 | 0.8339 |
| AGE | 1.18 | 0.8440 |
| GENDER | 1.14 | 0.8790 |
| FBO | 1.13 | 0.8872 |
| MEAN VIF | 1.31 | |
| ***Breusch-Pagan test for heteroskedasticity*** | | |
| Chi-square | | 23.01*** |

Note: *** denotes 1% significant level. Source: Authors' computations

Maddala (2001) suggests that multicollinearity is present in a model if the VIF is greater than 10 and the tolerance is approximately closer to zero. The results show that none of the variables has a VIF greater than 10. The overall mean VIF is 1.31, which is far less than 10. This provides a clear indication that the explanatory variables are not correlated, and therefore the multicollinearity issue is absent. In addition, we tested for the presence of heteroskedasticity using the Breusch-Pagan test. The Chi-square value (23.01) from the Breusch-Pagan test is statistically significant at the 1% level, suggesting that there is heteroscedasticity (thus, the error term has non-constant variance) in the model. Refusal to address this issue could result in inconsistent and biased estimates. Therefore, the standard errors were estimated using a robust estimation approach, as suggested by Maddala (2001). The robust estimation corrected the heteroskedasticity problem.

The estimates of maximum likelihood for the determinants of farmers' access to credit are presented in Table 5, together with their marginal effects, standard errors, z-values and probabilities. The marginal effects are interpreted as a 10% change in the respective variables leading to a change in the dependent variable. *FARM2*, *FARM3*, *FBO*, *FRECORD*, *SAVINGS*, and *INTEREST* exhibit significant impacts on farmers' probability of accessing credit. The coefficients of *FARM2* and *FARM3* show significant positive effects on access to credit. The marginal effects of 0.1808 and 0.2249 imply that medium- and large-scale farmers have 1.808% and 2.249% probability to access credit. The results indicate that farmers who are operating under large- and medium-scale production have a higher likelihood of securing a loan from financial institutions than smallholder farmers. Large- and medium-scale farming enterprises require higher capital investments, and one of the avenues to increase their capital base is to secure a loan. In addition, financial institutions are more willing to grant loans for medium- and large-scale farmers than for smallholder farmers, who usually produce to feed the family and sell the surplus. Our finding is consistent with that of Awotide, Abdoulaye, Alene and Manyong (2015), who observed that large farms tend to gain access to credit.

The coefficient of farmer based organisation (*FBO*) shows a positive effect and is statistically significant at the 10% level, indicating that farmers who belong to farmer association are more likely to have access to credit from financial institutions than their counterparts. The marginal effect of 0.1469 suggests that farmers who are members of farmers' associations have a 1.469% probability to access loans compared to those who do not belong to any farmer association. In some African countries, including Lesotho, farmers form associations to easily secure loans from financial institutions, where group members become their guarantors. When a member defaults in his/her loan repayment, the group members are liable to defray the loan. For this reason, the members strictly ensure that everyone pays their loans. Due to this self-check mechanism of most farmer associations, financial institutions are more willing to provide a loan facility to them.

Table 5. Determinants of farmers' access to credit

| Variable | Parameter | Coefficient | Marginal effects (dy/dx) | SE | z-value | Prob |
|---|---|---|---|---|---|---|
| CONSTANT | $\Phi_0$ | -2.8179** | | 1.2649 | -2.23 | 0.026 |
| REGION | $\Phi_1$ | -0.3474 | -0.0569 | 0.4558 | -0.76 | 0.446 |
| GENDER | $\Phi_2$ | 0.0156 | 0.0026 | 0.3959 | 0.04 | 0.968 |
| AGE | $\Phi_3$ | -0.2236 | -0.0366 | 0.3252 | -0.69 | 0.492 |
| EDUCATION | $\Phi_4$ | -0.1840 | -0.0301 | 0.1514 | -1.22 | 0.224 |
| ARITHMETIC | $\Phi_5$ | 0.2212 | 0.0362 | 0.2333 | 0.95 | 0.343 |
| FARM2 | $\Phi_6$ | 1.1042** | 0.1808 | 0.5421 | 2.04 | 0.042 |
| FARM3 | $\Phi_7$ | 1.3733*** | 0.2249 | 0.4036 | 3.4 | 0.001 |
| EXTENSION | $\Phi_8$ | -0.2796 | -0.0458 | 0.5740 | -0.49 | 0.626 |
| FBO | $\Phi_9$ | 0.8970* | 0.1469 | 0.4603 | 1.95 | 0.051 |
| FRECORD | $\Phi_{10}$ | 1.1846*** | 0.1940 | 0.4709 | 2.52 | 0.012 |
| SAVINGS | $\Phi_{11}$ | 0.9600** | 0.1572 | 0.4792 | 2.00 | 0.045 |
| INTEREST | $\Phi_{12}$ | -0.0356** | -0.0058 | 0.0179 | 1.98 | 0.047 |
| *Diagnostic statistic* | | | | | | |
| Wald Chi-square | | 54.03*** | | | | |
| Pseudo $R^2$ | | 0.4503 | | | | |
| Log likelihood | | -32.0588 | | | | |

Note: *,**,*** indicate 10%, 5%, and 1% statistical significance. Prob indicates the associated probability values. Source: Authors' computations

The empirical results show that financial record keeping (*FRECORD*) exerts a significant, positive effect on farmers' access to credit. This result indicates that farmers who keep financial record are more likely, by a magnitude of 1.940%, to have access to a loan. Most of the financial institutions examine farmers' creditworthiness and repayment ability to determine the level of risk associated with giving out loans to them. They do this by evaluating the financial position of the farmers using their financial records related to their farm operations. Therefore, farmers who keep a record of their financial transactions have a higher probability of getting loans from financial institutions. Keeping of financial records demonstrates the seriousness that farmers attached to their farming businesses. Our finding is consistent with that of Yuko, Jesim and Mandira (2015) who indicated that lenders may utilise financial statements and enterprises' performance, such as sales and profits, to assess repayment prospects. However, small enterprises in developing countries may not have complete financial statements, and more time therefore is required to evaluate their creditability.

The coefficient of *SAVINGS* is statistically significant at the 5% level and is shown to have a positive impact on farmers' likelihood to access credit. The marginal effect of 0.1572 indicates that farmers who save some portion of their farm revenue are more likely, by 1.572%, to get loans from microfinance institutions. These farmers are more likely to save with some financial institutions. Therefore, getting loans becomes easier compared to those farmers who do not save with the financial institution. Our finding collaborates with a recent study by Donkor and Anane (2016). The researchers ascertained that improving the farmers' savings behaviour increased their chance of getting loans from financial institutions in Ghana.

Interest rate is negatively related to the probability of farmers accessing loans from financial institutions. The marginal effect of -0.0058 indicates that 10 percent increase in interest rate would lead to 0.058% reduction in the probability that farmers would apply for loan at the financial institution. This result implies that higher interest rates deter farmers from applying for loans at financial institutions. Higher interest rates tend to increase the cost of production, which exerts pressure on the farmers, most of whom also are risk averse. The high production cost in turn minimises farmers' profit margin. As shown in Table 1, the average interest rate is 21.70%, which is high.

In the second stage of the empirical analysis, we estimated a model for the amount of credit farmers receive from financial institutions using the Tobit regression model. The results from the Tobit regression model are shown in Table 6. The Tobit estimates reveal that medium- (*FARM2*) and large-scale farms (*FARM3*) and repayment record (*REPAYMENT*) exert significant positive effects on the size of loans received, while interest rate (*INTEREST*) shows a negative effect. The results reveal that medium- and large-scale farmers receive M6 4250.46 (US $5 292.024) and M159 045.8 (US $13 099.8929) loans, respectively, bigger than those received by smallholder farmers. As already mentioned, the capital requirements for medium- and large-scale farmers are higher than smallholder production. They require finance to procure farm implements, irrigation facilities, labour, and other farm inputs, including agrochemicals. Interest rate exerts a negative effect on the size of the loan obtained by farmers, suggesting that, as interest rate increases, farmers are less likely to decrease the size of loan applied for by M5 358.334 (US $440.930). Interest rate increases the cost of procuring a loan, which in turn, increases the cost of production. This suggests that, when interest rates are higher, farmers tend to apply for smaller loans to reduce the risk of default. Repayment positively influences the amount of loan received by the farmers. Farmers who have good loan repayment records are likely to increase the size of the loan obtained by M53 788.27 (US $4 430.300). Farmers are sometimes denied loans simply because they have defaulted or have bad loan repayment records.

Table 6. Determinants of amount of microloan received by farmers

| Variable | Parameter | Coefficient | SE | z-value | Prob |
|---|---|---|---|---|---|
| CONSTANT | $\delta_0$ | -202321.5** | 82347.46 | -2.46 | 0.016 |

| | | | | | |
|---|---|---|---|---|---|
| REGION | $\delta_1$ | 43964.15 | 29179.45 | 1.51 | 0.135 |
| GENDER | $\delta_2$ | -8506.284 | 28973.16 | -0.29 | 0.77 |
| AGE | $\delta_3$ | 357.8165 | 19167.51 | 0.02 | 0.985 |
| EDUCATION | $\delta_4$ | -8576.466 | 15782.17 | -0.54 | 0.588 |
| ARITHMETIC | $\delta_5$ | 37532.95 | 55319.4 | 0.68 | 0.499 |
| FARM2 | $\delta_6$ | 64250.46** | 28901.12 | 2.22 | 0.029 |
| FARM3 | $\delta_7$ | 159045.8*** | 46832.67 | 3.4 | 0.001 |
| FBO | $\delta_8$ | -4780.194 | 34624.83 | -0.14 | 0.891 |
| FRECORD | $\delta_9$ | 9227.988 | 22840.85 | 0.4 | 0.687 |
| SAVINGS | $\delta_{10}$ | 31807.44 | 26797.92 | 1.19 | 0.238 |
| INTEREST | $\delta_{11}$ | -5358.334*** | 1616.275 | 3.32 | 0.001 |
| REPAYMENT | $\delta_{12}$ | 53788.27* | 29973.1 | 1.79 | 0.076 |
| *Diagnostic statistic* | | | | | |
| LR Chi-square | $\delta_1 + \delta_2 +, ..., \delta_{12} = 0$ | 69.74*** | | | |
| Pseudo $R^2$ | | 0.0596 | | | |
| Log likelihood | | -549.9313 | | | |

Note: *, ** and *** denote 10%, 5% and 1% statistical significance levels, respectively. Prob denotes the associated probability values. Source: Authors' computations.

### 4.3 Evaluating propensity score-matching estimate

The last stage of the empirical analysis involved an estimation of the impact of access to a loan on total farm net revenue using the propensity score-matching method. Specifically, the nearest neighbour, kernel, and radius-matching methods, which are commonly applied in empirical studies, were used in this study. The results are provided in Table 7. All the matching methods, except kernel, show that access to credit exerts a significant positive impact on total farm net revenue.

| Outcome variable | Matching algorithm | Treated | Control | ATT | t-value |
|---|---|---|---|---|---|
| Total farm | Nearest neighbour | 2429.019 | 766.981 | 1662.038** | 2.43 |
| Net revenue | Kernel | 2429.019 | 1042.698 | 1657.706 | 1.02 |
| | Radius | 2429.019 | 1016.926 | 1412.092*** | 2.96 |

Note: ** and *** denote 5% and 1% statistical significance levels, respectively. Source: Authors' computations.

The ATT from nearest neighbour is M1 662.038 (US $136.894), and it is statistically different from zero at the 5% level. This finding suggests that access to credit tend to increase farmers' net revenue by M1 662.038 (US $136.894). The ATT from kernel is M1 657.7065 (US $136.538)

which statistically not significant even at the 10% level. The radius-matching method shows that access to credit significantly increases farm net revenue, by M1 412.0929 (US $116.608), which is less than the ATT from the nearest neighbour and kernel methods.

Our empirical findings are consistent with the extant studies (Carter, 1989; Hazarika and Alwang, 2003; Petrick, 2004; Mohsin, Ahmad and Anwar, 2011; Chisasa, 2014; Awotide et al., 2015). These studies concluded that credit improved farm output and incomes. However, empirical evidence from Obilor (2013) suggested that commercial banks' credit to the agricultural sector had no significant impact on agricultural productivity growth in Nigeria. Access to adequate credit affects farm output by easing the financial constraints of the producers in purchasing productive farm inputs such as agrochemicals, seeds, labour, mechanisation, and irrigation facilities. This encourages the efficient allocation of these farm inputs. This effect tends to shift the producer along a given production surface to a more intensive and remunerative input combination. Carter (1989) posited that if credit is used to purchase a new package of technology, including high-yielding seed variety and other farm technologies, it would enable farmers to operate on the production frontier and also shift the entire input-output surface. The effect is the increment in the production efficiency, which in turn, raises the total farm income generated. The implication of our finding is that increasing farmers' access to credit has a significant positive effect on their farm incomes, which in turn, will promote farmers' welfare and stimulate rural development in Southern African, particularly in Lesotho.

Table 7. Estimates of the average treatment effect on the treated (ATT)

| Outcome variable | Matching algorithm | Treated | Control | ATT | t-value |
|---|---|---|---|---|---|
| **Total farm** | Nearest neighbour | 2429.019 | 766.981 | 1662.038** | 2.43 |
| **Net revenue** | Kernel | 2429.019 | 1042.698 | 1657.706 | 1.02 |
| | Radius | 2429.019 | 1016.926 | 1412.092*** | 2.96 |

Note: ** and *** denote 5% and 1% statistical significance levels. 1 USD = 12.141 Lesotho Maloti (M) as at November 2015. Source: Authors' computations

The matching process was tested to check whether it balances the distribution of the explanatory variables in both the treated and control observations. The statistical test of selection bias after matching is provided in Table 8 to confirm the validity of the ATT estimate. The propensity score test shows a significant reduction in bias after matching. In addition, there are no significant differences in matched non-borrowers and borrowers for any of the covariates (Table 8).

Table 8. Test of selection bias after matching

| Variable | Treated (Mean) | Control (Mean) | % bias | t-value | P > \|t\| |
|---|---|---|---|---|---|
| REGION | 0.6 | 0.8325 | -46.7 | -1.41 | 0.169 |

| | | | | | |
|---|---|---|---|---|---|
| GENDER | 1.2667 | 1.1895 | 15.3 | 0.49 | 0.629 |
| AGE | 2.3333 | 1.9368 | 56.8 | 1.37 | 0.18 |
| ARITHMETIC | 3.6 | 3.4266 | 20.1 | 0.64 | 0.525 |
| EXTENSION | 0.8666 | 0.9328 | -22.7 | -0.59 | 0.562 |
| SAVINGS | 0.8666 | 0.8852 | -4.4 | -0.15 | 0.882 |
| FBO | 0.2666 | 0.0805 | 46.6 | 1.34 | 0.191 |
| EDUCATION | 2.1333 | 2.3263 | -14.4 | -0.36 | 0.72 |
| FARMSIZE2 | 0.1333 | 0.1954 | -17.4 | -0.44 | 0.66 |
| FARMSIZE3 | 0.4666 | 0.4513 | 3.6 | 0.08 | 0.936 |
| INTEREST | 17.200 | 12.891 | 46.3 | 0.93 | 0.36 |

Source: Authors' computations

## 5. Conclusion and policy recommendation

Access to credit and financial services is important for the improved wellbeing of rural households, especially when advancing agricultural development in developing countries such as Lesotho. This paper therefore has examined farmers' access to credit and its impact on farm net revenue using a two-stage model and the propensity score-matching method, respectively. The first stage involved determining the factors that influence farmers' decisions to access a loan using a probit regression model. In the second stage, the factors influencing the size of the loan obtained by farmers were analysed using a Tobit regression model. The impact of credit was estimated with the propensity score matching, using three matching methods, namely nearest neighbour, kernel, and radius. The study was conducted in Lesotho with a sample size of 100 farmers. Our findings show that rural, small-scale farmers in Lesotho have limited access to credit. This credit constraint has seriously hampered the agricultural sector's development and, to a large extent, limited attempts to alleviate poverty in Lesotho. The probit estimates revealed that farmers operating under medium- and large-scale production have a higher propensity to access credit. Farmers' membership of farmers' associations increases their likelihood of getting credit from financial institutions. Keeping the financial records of farm operations also enhances farmers' probability to access credit. Saving with a financial institution was found to exert a significant effect on the probability of accessing credit. On the other hand, increasing interest rates deter farmers from accessing credit, as higher interest increases a farmer's cost of production. Moreover, the empirical findings from the Tobit regression indicate that medium- and large-scale farmers tend to receive larger loans from financial institutions compared to smallholder farmers. A good repayment history increases farmers' chances of receiving larger amounts of credit. However, higher interest rates tend to reduce loan amounts. The estimates from the propensity score matching show that access to credit promotes farmers' welfare by increasing their net revenues by M1 412.0929 (US $116.608) to M1 662.038 (US $136.894). The conclusion drawn from the study is that scale of production, repayment history, savings and interest rate significantly influence farmers' access to credit. In addition, increasing farmers' access to credit can promote agricultural and rural development by enhancing farmers' net revenues because many rural people depend on agriculture for their livelihoods.

Based on the key findings of the study, the following policy recommendations are proposed. First, the study strongly advises farmers to keep proper financial records of their farming business operations to increase their creditworthiness. We also encourage farmers to form or join farmer organisations to enable them to access credit through the association. The interest rate in Lesotho

was found to be higher, calling for urgent measures from the government to curtail the prime rate to enable financial institutions to offer loans low rates. It is expected that the effective implementation of these policy recommendations will stimulate better access to credit among farmers in Lesotho.

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