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Determinants of Smallholder Vegetable Farmers Credit Access and Demand in Southwest region, Cameroon

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Abstract

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1. Introduction

The idea that peasant farmers are rational profit maximizers has been a topic of development economics since Schultz (1964). Farm credit is widely recognized as one of the important factors to increase agricultural productivity, farm incomes and thereby alleviate poverty. Credit has been increasingly accepted as a powerful instrument to lift the rural poor from abject poverty. According to Amha and Narayana (2000) and Djoumessi et al. (2018), it plays an essential role in increasing agricultural productivity through building up product assets. Some financial programs which had been led by the Cameroonian government, have not impacted significantly in terms of improving access to credit by the majority of the female farmers in rural zones as they are mostly highly marginalized. It is male headed household who is usually considered and registered for the provision of institutional credit. In Southwest region of Cameroon however, small-scale farmers engaged in vegetable production are mostly women. Indeed, vegetables are among the most delicate crops, requiring tender care. It is important for farmers to respect agro-chemical application regimes and ensure they are not constrained by unavailability of credit to finance such activities. However, the probability of demanding credit is negatively correlated with being female headed households (Nwaru et al., 2011). Most poor families in rural areas where women beside farming are responsible for several household chores such as feeding; a deprived credit access constitute a critical constraint to adoption and use of improved inputs thereby leading to food insecurity and malnutrition of rural populations. Credit can transform self-image, unlock potential and boost the productivity and well-being of the poor and vulnerable, especially farmers (Akudugu, 2012; Djoumessi et al, 2018). Borrowing credit can be seen as an option to supplement insufficient cash in order to finance factor inputs such as seeds and hired labour as well as household expenditures such as school fees, etc. (Bidogeza et al., 2015). Access to and demand for credit have remained a major problem faced by smallholder farmers particularly female farmers in rural zones.

2. Literature review

Many studies have attempted to identify factors that influence rural households' access to credit (Adegbite & Adeleye, 2011; Nwaru et al., 2011; Shela & Saf, 2007). However, only few studies have focused on marginalized smallholders farmers in general, and specifically womens' access to credit (Buvinic et al., 1979; Mohamed & Temu, 2009). Chauke et al. (2013) examined factors that affect smallholder farmer's access to credit in the Capricorn District in South Africa, using a logistic regression model. Determinants to credit access were the need for credit, attitude towards risk, distance between lender and borrower, perception on loan repayment and total value of assets. Adugna and Heidhus (2000) found an inverse relationship between resource endowment and the desire to borrow from informal sources in Lume district, Ethiopia. Ng'eno et al. (2011) studied farmer's inaccessibility to agricultural credit in Nyandarua district, Kenya. The study established that socio-economic constraints are critical determinants of access to credit. Akpan et al. (2013) examined the determinants of access and demand for credit among poultry farmers in southern Nigeria, using an independent double hurdle model. The first hurdle model revealed that socio-economic factors and distance to lending source are important determinants of access to credit. On

the other hand, the amount of loan demanded by the poultry farmers was significantly influenced by cost of hired labour, previous years of experience on credit, presence of a collateral/surety and net farm income. To the best of our knowledge, there is no such specific study on credit access for smallholder vegetable farmers in the case of Cameroon. Further, most of empirical studies assume the hypothesis of a joint decision for access and demand, whereas ideally, these are two different stochastic process as opposed to a single process. So, the objective of this paper is to estimate the determinants of credit access and demand by smallholder vegetable farmers in the southwest region of Cameroon.

3. Methodology and data

3.1. Study area

This study was carried out in Southwest region[1] of Cameroon, a region that plays a strategic role in the Cameroonian economy with oil production and the existence of huge agro-industries[2]. The study focused on three representative districts namely: Kumba 1, Kumba 2 and Tombel (See the appendix 5), given the importance of vegetables in these locations (MINADER, 2006). These districts falls under the zone of the hot and wet equatorial agro-climate with two main crop production seasons: one rainy season with abundant and regular rains which lasts from March to October and one dry season which lasts from October to March with average annual rainfall of 2849 mm and 409 mm, respectively.

3.2. Methods

Empirical studies mainly focused on assessing the determinants of the amount of credit taken over a fixed period of time as a joint decision. The distribution of loan is continuous over positive values, as far as none of the farmers can have a negative credit balance. One common approach used to modeling this situation is the Tobit model. However, the decision taken by farmers to demand credit is preceded by the decision to have "access to credit". Thus if there exists any correlation between these two decisions, the Tobit model can no longer properly handle the situation. It might be the case that net farmer's income lowers the probability to access credit. But if farmers are used to demand credit, net farmer's income might increase the amount of credit. Many empirical studies have rejected the standard Tobit model (Haines et al., 1988; Jones, 1992; Yen, 1993; Gao et al., 1995; Yen et al., 1996; Jones and Yen, 2000; Moffatt, 2005; Yimer, 2011), showing that the "double hurdle" model, specifically the Cragg double hurdle model provides a better representation of the factors that affect the separate decisions of access and demand levels. Therefore, we should better analyze determinants of credit as two consecutive decisions taken by farmers. A double-hurdle model was originally formulated by Cragg (1971). Jones (1992) applies

[1] It is a forest zone with 58 inhabitants per km^2 and the soil is very fertile and suitable for agriculture. The main crops produced in the region are: rubber, cocoa and palm oil. Exotic vegetables and cassava are mainly cultivated by female farmers, most of the time close to the husband's plot. Additionally, the area has been subject to growing population in urban and peri-urban communities, and an increasing social and ethnic heterogeneity through increased migration and greater social mobility, as well as an increasing exposure to forces of globalization and the commoditization of natural resources.

[2] Agro-industries such as the Cameroon Development Corporation (CDC), a parastatal slowly privatizing company. CDC not only provides labour and employment opportunities, but links the local economy of the region to regional and international markets as well as creating and maintaining rural infrastructure

the double-hurdle model with correlation in the error terms to data on tobacco expenditures. The backbone of the model is based on the fact that farmers make two consecutive decisions with regard to access and demand to credit, each of which is determined by a different set of explanatory variables. Suppose that farmers make their credit decision in two steps. First, the farmer determines whether he want or does not want to have access to credit. Then the farmer determines an optimal amount of loan borrowed regarding his or her constraints/needs. The model considers the possibility of zero outcomes in the second hurdle arising from the farmer deliberate choices or random circumstances. Further, the dependent variable should have a "corner" at zero because non-borrowers will report zero credit values. According to Green (2003), zero values can be reported in both decision stages. In the first stage, the zeros reported arise from zero access to credit by the smallholder farmer. Then in the second hurdle the zeros reported come from zero loan acquisition from any credit source due to a farmer's deliberate decision or random circumstances. We can model the acquisition of credit as:

$$\begin{cases} y_i = x_i\beta + u_i \quad if \ \min(y_{i1}^*, y_{i2}^*) > 0 \\ y_i = 0 \quad otherwise \end{cases}$$

$$y_{i1}^* = w_i\alpha + v_i \quad access\ decision \tag{1}$$

$$y_{i2}^* = x_i\beta + u_i \quad demand\ decision \tag{2}$$

Where y_{i1}^* is a latent variable describing the smallholder farmers' decision access to credit, y_{i2}^* is a latent variable describing smallholder farmers' decision demand to credit; y_i is the observed dependent variable (acquisition of loan or credit); w_i and x_i are vectors of variables explaining access to and demand to credit respectively; α and β are vectors of parameters; v_i and u_i the respective error terms[3].

3.3. Models Specification

A large set of empirical works provide guidance as to which explanatory variables to include in the first and second hurdle of the model. However, including the same set of independent variables in each hurdle makes it difficult to identify the parameters of the model correctly and so exclusion restriction must be imposed (Jones, 1992). The first hurdle equation includes the following explanatory variables (appendix 1):

$$y_1^* = \alpha_0 + \alpha_1 Age + \alpha_2 Education + \alpha_3 extension\_service + \alpha_4 farmers\_association + \alpha_5 distance + v \tag{3}$$

Where y_1^* is credit access which takes the value 1 for those that have access and 0 otherwise.

The second hurdle includes the following variables:

$$y_2^* = \beta_0 + \beta_1 Age + \beta_2 Farm\_size + \beta_3 Labor\_cost + \beta_4 distance + \beta_5 Education + \beta_6 owner + \beta_7 Extension\_service + \beta_8 farmers\_association + \beta_9 Interest\_rate + \beta_{10} income + u \tag{4}$$

[3] v_i and u_i are jointly normal and may be correlated, such as:

$$\begin{pmatrix} u_i \\ v_i \end{pmatrix} \sim N(0, \Sigma), where\ \Sigma = \begin{pmatrix} 1 & \sigma_{12} \\ \sigma_{12} & \sigma \end{pmatrix}$$

Where y_2^* is the observed amount of loan borrowed by the sampled respondent[4]. Appendix 2 describes independent variables added to those one already cited above (appendix 1).

3.4. Data Collection

Data were collected from a total of 100 smallholder vegetable farmers selected through a two-stage stratified sampling from the three agricultural production baskets in the region, according to the Ministry of Agriculture and Rural development. First, a map of the region provided by the Ministry was used as a sampling frame to purposively select 5 villages from the three districts, based on information on vegetable farms. In the second stage, a total of 20 vegetable farmers were randomly selected from each of the 5 villages. A structured questionnaire was then used to elicit data[5] from respondents during the cropping season, March 2014 to January 2015 as the reference period for the study.

4. Results

4.1 Estimates from the Tobit model

First, the problem of multi-collinearity was checked through the variance inflation factor (VIF) test to ensure the consistency of the Tobit model parameters. The presence of collinearity in the results of VIF test enable us to remove income variable and the final results with no significant collinearity are depicted in appendix 4. Then, we regress factors affecting the amount of loan of small-scale farmers using Tobit model. The results show that belonging to a farmers' association, farm size, education and extension service have a positive and significant influence on the amount of loan received by farmers (table 1). From the Tobit model results, we can strongly attest that the level of education of farmers is a crucial factor determining the amount of loan applied for by farmers. An increasingly number of recent works are in straight line with this result (Elias et al, 2015; Oboh and Ekpebu, 2010; Oboh and kushwaha, 2009). But the censored Tobit model assumes that the farmer's decision to access and on how much to applied for credit if access occurs are both determined by the same process, which is a strong hypothesis.

4.2 Estimates from the Cragg double-hurdle model

Unlike the Tobit model, the Cragg double-hurdle model assumes the existence of an independent decision between the two stochastic processes. Table 2 shows the estimated parameters of a double-hurdle model. In the econometric sense, the model allows an estimation of parameters from two equations. The first displays the coefficients of the quantity equation (credit demand), which is titled "Demand" after the dependent variable. The second equation displays the coefficients of the participation equation (credit access) titled "peq", which is short for access equation. As expected, the estimated value of the covariance between the error terms of the quantity equation and the access equation is statistically significant (5%). We should mention that the variable

[4] For a smallholder who does not borrow, y_2^* cannot be measured and was set to be equal zero. This indicates that the observed loan borrowed is zero either when there is censoring at zero $y_2^* \leq 0$ or if there is faulty reporting, or due to some random circumstances.

[5] Information collected included: socioeconomic characteristics of sampled respondents, institutional and environmental characteristics, quantities of inputs and outputs, and used for vegetable production as well as unit market prices.

interest rate has been removed from the regression estimates. Because, farmers accessing credit take loan at the same interest rate whatever the amount of credit.

Table 1: Tobit estimates of vegetable farmers' demand to credit

Variables	Coefficient
age	-0.163
	(0.228)
farmers association	10.423***
	(5.749)
owner	0.641
	(5.380)
distance	6.485
	(6.144)
farm size	8.726**
	(6.095)
education	5.204**
	(5.586)
lnlaborcost	0.765
	(4.156)
Extension service	4.373**
	(5.027)
_cons	-15.600
	(44.176)

Robust standard errors in parentheses

*** p<0.01, ** p<0.05.

First, robustness tests are addressed through the choice of explanatory variables as depicted in the five models. We observe (table 2), significant variables in the original model (3) consistently remain significant and with the same sign in others models. The results of the access equation show that coefficients of education, membership to a farmers' association, extension services and distance from credit sources are positives and statistically significant with the probability to access credit by vegetable farmers in the study area. This implies that as the foregoing factors increase, the probability to have access to credit increases. Specifically, more educated farmers are more opened to new innovations and better management practices. Belonging to a farmers' association provides support information and knowledge relating to vegetable farms and production. An increase in farm size could be an incentive to enhance credit access in other to improve vegetable productivity. In addition, vegetable farmers with a higher frequency of contact with agricultural extension agents are aware about any agricultural credit sources when they exist. Therefore, they have much better access than those with less frequency of extension contact. The result highlights that distance from farmer's resident to credit sources implies that vegetable farmers who live further away from the credit sources are less likely to consider decision to access credit compared to those who live closer to the credit sources. The findings for education, farmers' association, extension services and farm size corroborate the research findings of other scholars on similar studies such as Akpan et al. (2013), Zeller (1994) and Elias et al. (2015). The result for distance

goes in the same way with findings of Oboh and Kushwaha (2009). However, the coefficient of education has a positive and significant value on the access equation, while the analogous coefficient in the demand equation does not have a significant value. This implies that education of vegetable farmers only affects the access decision. Further, this result confirms the strengths of the double-hurdle model in providing additional information and unbiased estimates.

Table 2: Double-hurdle estimates of vegetable farmers' access and demand to credit

		(1)	(2)	(3)	(4)	(5)
Demand						
	age	0.023	0.025	0.033		0.019
		(0.034)	(0.031)	(0.040)		(0.056)
	Farmers association	4.729***	3.375***	3.340***		2.178***
		(1.262)	(1.279)	(1.283)		(1.204)
	owner	-1.043	-0.354	-0.327		-0.334
		(0.944)	(0.889)	(0.915)		(0.926)
	distance		1.614**	1.682**		0.525**
			(1.206)	(1.182)		(1.326)
	farm size		2.829**	2.642**	2.463**	1.472**
			(0.897)	(1.328)	(1.357)	(1.655)
	education			0.344	0.557	0.365
				(0.901)	(0.860)	(0.944)
	lnlaborcost			0.188	0.915	0.701
				(0.935)	(0.948)	(3.217)
	extension service				2.164*	0.141*
					(1.504)	(1.602)
	_cons	1.759	2.148	0.67	9.664	0.652
		(1.400	(1.647)	(9.342)	(9.787)	(12.012)
peq						
	age	-0.005	-0.004	-0.004		-0.074
		(0.003)	(0.002)	(0.002)		(0.002)
	farmers association	0.521**	0.199**	0.199**		1.354*
		(0.108)	(0.107)	(0.107)		(0.119)
	extension service		0.773***	0.773***		0.0750***
			(0.075	(0.075)		(0.065)
	distance				0.215*	1.507*
					(0.152)	(0.077)
	education				0.101**	0.164**
					(0.101)	(0.065)
	_cons	0.370**	0.263**	0.263**	0.491**	2.144*
		(0.159)	(0.110)	(0.110)	(0.151)	(0.140)

Robust standard errors in parentheses

*** p<0.01, ** p<0.05, * p<0.1

Regarding the demand equation, coefficients of distance, membership of a farmers associations, extension services and farm size are significant and positively related to the amount of loan borrowed by vegetable farmers in the study area. This implies that increase the vegetable farmers' cultivated land will increase the demand for credit. Certainly due to the fact that increased farm size requires additional costs. In addition, vegetable farmers taking advantage of extension services tend to have more access to credit. This corroborates the results of Oboh and Kushwaha (2009) and Apkan et al (2013). The distance from farmer's resident to credit source plays a crucial role in the amount of loan borrowed. Additional costs (transaction) due to transport fee can be one of the reasons; Oboh and Kushwana (2011) found the same result. Membership to a farmers' association implies that vegetable farmers gathered in associations benefit from non-rationing credit. This result is aligned with research findings of Lawal et al. (2009). Comparing the results between the Tobit model and double hurdle model, we notice that education is significant in the access equation while it is not significant in terms of its effecto the amount of loan in the demand equation of the double hurdle model but it is significant in the Tobit model. This implies that estimates from the Tobit model captured the demand decision at the level of access decision. This result goes along with the findings of Haines et al (1988) and Yimer (2011).

5. Conclusion

This paper estimated the determinants of credit access and demand by smallholder vegetable farmers in southwest region, using the Cragg double hurdle model. First, the results of the access equation show that education, membership to a farmers' association, extension services and distance to credit source are positives and statistically significant with the probability to access credit by farmers. This implies that as the foregoing factors increase, the probability to have access to credit increase too. Regarding the demand equation, distance, membership of a farmer's associations, extension services and farm size are significant and positively related to the amount of loan borrowed by farmers. Further, we find that education is significant in the access equation while it is not in the demand equation of the double hurdle model, but it is significant in the Tobit model. It means that estimates from the Tobit model captured the demand decision at the level of access. In order to improve small and marginal vegetable farmer's access and demand to credit in southwest region, Cameroon. The following recommendations are made: (i) To bolster the extension program dealing with efficient use of credit demand for young female farmers; (ii) Government should encourage credit institutions to increase lending agencies nearer villages located far from the town centre; (iii) Encouraging vegetable farmers to subscribe and exercise their membership rights to a farmers' association.

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