Determinants of Access to Farmers' Organization Input Credit among Smallholder Sugarcane Farmers in Tanzania: A case of Kilombero Valley

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Abstract

Agricultural financing is imperative for enhancing agricultural productivity and rural development in general. There have been several efforts from the government and other stakeholders in private sectors and non-governmental organizations to enhance input credit access to rural farm households. However, rural input credit market imperfection remains a predominant barrier, making, input credit access among smallholder farmers a less understood phenomenon. In this paper, the determinants of input credit access by smallholder farmers in Kilombero valley, Tanzania are analysed based on a cross-section survey involving 274 randomly selected smallholder sugarcane farmers. Applying the double-hurdle econometric approach, the study found that farm size, age, education, years of membership to farmers organization, and distance from farm to the factory as significant factors determining the probability of smallholder farmers accessing input credit. Similarly, fertilizer, membership to farmers organization, and distance from farm to the factory were significant determinants of the intensity of input credit access. The findings imply that policies that strengthen the rural input credit market are imperative for reducing transaction costs and easing liquidity constraints for purchasing critical agricultural inputs such as fertilizer, pesticides and improved seed varieties. The government should invest in financial literacy programs for smallholder farmers to help them understand credit options, manage their finances effectively, and use credit for productive purposes this is due to the fact that many smallholder farmers have primary level of education. However, limitation of this study is application of cross-sectional design, thus, a longitudinal study may offer a better option for causal-effect analysis.

Keywords: Smallholder Sugarcane Farmers, Access to Input Credit, Double-Hurdle model

Introduction

Agriculture sector acting as a vital part in the economy of countless countries in the world, mainly in the less developed countries where many households are based on agriculture as their main economic activity (Birhanu *et al.,* 2022). In Tanzania, in the year 2021, the agricultural sector contributed 30.1% of the country's GDP, 85% of country's exports and 80% of country's employment opportunities (URT, 2021). Despite of contributions from agriculture sector, its production and efficiency has been disappointing. Agricultural sector is characterized by low levels of production and efficiency which could hinder the economic growth of the country (Lema *et al.,* 2022). This is due to low utilization of modern agricultural inputs and technologies, such as improved seeds and industrial fertilizer which caused by the limited access to input credit (financial services). Access to input credit has been described as an important tool for sustainable development of agriculture in many countries in the world, because it enables smallholder farmers to access inputs such as improved seeds, industrial fertilizers and to hire labor when needed (Ayodeji & Abiodun, 2022). Similarly, access to input credit enables smallholder farmers to acquire productive resources, farm, machinery and other production input (Silong & Gadanakis, 2019; Nwandu, 2021).

However, despite this positive effect of agricultural input credit in improving farms productivity as well as farmers' wellbeing

in general, in many places in the developing world, access to input credit is still low (Lema *et al.,* 2022). In Tanzania, only 3.8 percent of smallholder farmers have access to input credit for agricultural activities, and the reasons for this situation are little known (URT, 2021). In the midst of these, different government and international agencies and other agricultural stakeholders employed number of efforts through policies reforms and program to improve accessibility of input credit among smallholder sugarcane farmers. Amongst the efforts include establishment of farmer organizations (FO's) with the main role of provide financial services to the smallholder farmers. These FOs were established to contribute in promoting access to input credit by ensure smallholder farmers are recognized by financial institutions and co-coordinating activities and making collective decisions (SBT, 2020).

According to SBT (2020), FOs are supposed to ensure there is sufficient access to input credit by first, prepare list of farmers who want to access input credit and the amount before the farming season start. Second, bargaining with financial institutions on the amount needed by their members and ensure member access input credit with low interest rate. Therefore, FOs borrow money on behalf of their members and distribute borrowed money to their members who need to access input credit. Third, at the end of farming season FOs collect money borrowed from financial institutions to their member and return accessed input credit. However, despite of the establishment of FOs to improve access to input credit among smallholder farmers, accessibility of input credit by smallholder farmers through FOs' input credit is still low (Machumu, 2017; Mesfin *et al.,* 2021; Midamba, 2022).

There is a substantial number of studies conducted to examine the determinants of access to input credit and its intensity among smallholder farmers. Most of these studies illustrate that institutional and socio-economic factors determine smallholder farmers' access to input credit. For example, Asante-Addo *et al.,* (2016), Tura *et al.,* (2017), Saqib *et al.,* (2018), Drisu *et al.,* (2019) and Nwandu, (2021) revealed that access to input credit can be determined by social-economic factors of smallholder farmer. such as age, age, level of education and level of income of farmer. Saqib *et al.,* (2018) showed that access to input credit can be determined by the age of farmer, gender, level of education and income level of a smallholder farmer. Similarly, Asante-Addo *et al.,* (2016) and Nwandu, (2021) indicated that access to input credit can be determined by institution factors. However, in spite of this contribution of these studies in numerous areas in the world, still smallholder farmers cannot access input credit easily.

Furthermore, Nwandu, (2021) concluded that access to credit and its size among smallholder farmers are influenced by factors namely amount of crops harvested on previous farming season, collateral (assets ownership), farming experience, level of education, and kind of agriculture (cash crop farming or subsistence farming). In addition, Saqib *et al.,* (2016) and Drisu *et al.,* (2019) revealed that the possibilities for a farmer to obtain credit for a larger farm investment are somewhat greater than for smaller rural firms. Also, Asante-Addo *et al.,* (2016), Isaga, (2018), and Ayodeji and Abiodun, (2022) showed that education level of smallholder farmers is among of the influential factor to the smallholder farmers' access to credit. Moreover, Tura *et al.,* (2017) found that gender have direct influence to the access to credit among smallholder farmers.

However, these studies are limited in terms of difference in methodological contexts hence results are not generalizable. These previous studies used both secondary data and primary data in which data were collected through documentary reviews, interview guides, and questionnaires. Also, these studies used ordered logistic model to analyze the determinants of access to input credit. The current study is an attempt to address such gap of knowledge in two fronts: first, the study examines the determinants of access to FOs' input credit and its intensity among smallholder sugarcane farmers by using primary and quantitative data only. Second, the study used double-hurdle model, which is one of the rigorous quasi-experimental methods. The current study is aimed at examine the determinants of access to FOs' input credit and its intensity in the Kilombero valley, Tanzania.

This will help policy makers formulate proper policies that will consider the positive factors and mitigate the negative factors.

Material and Methods

The study was conducted in Kilombero valley in June 2021. The valley is located in Kilombero and Kilosa districts in Morogoro region. The Kilombero valley was purposively selected as 97% of the Smallholder Sugarcane Farmers (SHSCFs) in Tanzania are found in this area and contributing about 45% to the Tanzania's total sugarcane production (URT, 2021). The research used stratified sampling technique to select respondents of the study. In Kilombero valley there are 15 FOs, and out of these the study purposively selected two FOs from which SHSCFs were randomly selected. The study selected Ruhembe Cane Growers Association (RCGA) and Kilombero Cane Growers Association (KCGA) because they have registered more than 50% of all SHSCFs in Tanzania and they are also the oldest (more than 30 years) and biggest farmer organizations in Tanzania (KCGA has 3507 members and RCGA has 3500 members) (URT, 2021).

Based on Yamane (1987), the study obtained a total of 358 SHSCFs in the sample, of which 178 SHSCFs were randomly selected from RCGA and 180 SHSCFs from KCGA. A structured questionnaire was distributed to the selected respondents. The survey questionnaire was pre-tested to 20 SHSCFs prior to the commencement of the full-scale survey. The pre-testing exercise was important for enhancing the content validity of the measuring instrument. During the data collection, out of 378 distributed questionnaires, 274 (in which 159 were from KCGA and 115 were from RCGA) were fully completed and submitted and make the 77% of response rate.

Analytical framework

Double-hurdle model

The farmers' decision to access FO's input credit is expected to be influenced by a set of farm characteristics, farmers characteristics, and institutional characteristics. For farmer to access input credit there is need to make either two decisions or one decision. First decision is deciding whether to access input credit or not to access and second decision is to decide the amount of input credit to access. Sometime farmer can make only one decision that is to decide to access input credit but not to decide to access on the amount of input credit to access. Thus, famer expected utility of access to FO's input credit or not to access and to access amount of FO's input credit can be expressed as follows:

$$EU_{kj}=\beta_k Z_j+\delta_{kj} \quad \text{……..(1)}$$

$$EU_{mj}=\beta_m Z_j+\delta_{mj} \quad \text{…....….(2)}$$

Where;

EU_{kj} and EU_{mj} = The expected utility of farmers in the first decision (whether to access input credit or not) and second decision (deciding the amount of input credit to access), respectively.

β_k and β_m = Coefficients or parameters associated with the variable Z_j in their respective equations.

Z_j = Set of independent variables or characteristics of the farmer (farm characteristics, farmer characteristics, institutional characteristics, etc.) that are believed to influence the farmer's decision regarding input credit access.

$\beta_k Z_j$ = Linear relationship between the set of independent variables Z_j and the expected utility of accessing FO's input credit for the first decision (whether to access or not).

$\beta_m Z_j$ = Linear relationship between the same set of independent variables Z_j and the expected utility of accessing FO's input credit for the second decision (the amount of input credit to access).

δ_{kj} and δ_{mj} = Error terms that capture unobserved or random factors affecting the farmer's expected utility. These terms account for factors that are not explicitly included in the model but may still affect the farmer's decision

Then the difference in expected utility (difference between two decisions) may be written as:

$$EU_{mj}-EU_{kj}=(\beta_{mj}Z_j+\delta_{mj})-(\beta_{kj}Z_j+\delta_{kj}) \quad \text{….....….(3)}$$

$$EU_{mj}-EU_{kj}=(\beta_m-\beta_j)Z_j+(\delta_{mj}-\delta_{kj})=\beta Z_j+\delta_j) \quad \text{.....(4)}$$

If $EU_{mj}-EU_{kj}>0$, it suggests that farmer derives more expected benefit from the first decision compare to the second decision. The SHSCFs will prefer to access FO's input credit or not compared to decide the amount of input credit. Thus, the difference of the expected utility

between access to FO's input credit and not to access to FO's input credit is the potential factor that influences the SHSCF's decisions.

The study used double-hurdle model to examined the determinants of access to farmers organization's (FO's) input credit and its intensity among SHSCFs. The selection of the double-hurdle model came after testing two popular models used in the analysis of two decisions namely double-hurdle model and Tobit model. The double-hurdle model assumes that independent variables do not impact two decisions (i.e., first decision is to decide whether to access input credit or not and second decision is to decide the amount of input credit to access). This means factors which affect smallholder farmers to decide to access FOs' input credit or not, are different from factors which affect smallholder farmers to decide amount of input credit to access. While Tobit model assumes that independent variables impact the two decisions in exactly the same way as they impact the decision on the extent. Based on this study, the Tobit model assumes that the same factors impact both access to FO's input credit and its intensity in the same direction. This study used Log likelihood ratio test to select appropriate model between double-hurdle model and Tobit model to present data. The result shows that test statistics is 52.56 and p-value is 0.1132, the log likelihood of the Tobit model was rejected and accepted the alternative hypothese as log likelihood of the double-hurdle model is significant. The result concluded that double-hurdle was more accurate representation of the data. In addition, when a SHSCF access FO's input credit, it is difficult to predict the actual amount of input credit that will be accessed. Therefore, the double-hurdle model, is more suitable to use in analyzing the determinants of access to FO's input credit and its intensity.

Access to FOs' input credit and its intensity were modelled in two steps. First, the probability of whether SHSCFs access FO's input credit or not. Second, if SHSCFs access FO's input credit, to what extent the average amount of input credit deviate from the amount of FO's input credit to SHSCFs. When confronted with a choice between whether to access FO's input credit or not, the SHSCF would compare the expected utility of accessing FO's input credit with not accessing FO's input credit.

For this study, SHSCF undergoes two sequential hurdles, the first hurdle is whether SHSCF access FO's input credit or not, and the second hurdle is the difference between the amount of input credit accessed and the total amount of input credit needed by SHSCF (intensity of accessing input credit).

The double-hurdle model assesses not only the probability of SHSCF to access FO's input credit, but also the intensity of access to FO's input credit measured by the total amount of input credit obtained by SHSCF for the farming season under study in relation to the farm characteristics, farmers characteristics, and institutional characteristics. The double hurdle model assumes that there is a latent unobserved variable g_i^* that depends linearly on Z_i through a parameter vector α. There is a normally distribute error term ε_i to capture the random influence on this relationship. The observed variable g_i is defined as being equal to the latent variable whenever the latent variable is above zero and equal to zero otherwise.

$$g = \begin{cases} g_i^* \; if \; > 0 \\ 0 \quad if \; g_i^* \leq 0 \end{cases} \qquad \text{.....(5)}$$

Where g_i^* is a latent variable;

$$g_i^* = \alpha Z_i + \varepsilon_i, \varepsilon_i N(0, \delta^2) \qquad \text{.....(6)}$$

If the relationship parameter α is estimated by regressing the observed Z_i on g_i the resulting Ordinary Least Squares estimator (OLS) is inconsistent. Garcia, (2013) has proven that the likelihood estimator suggested by Tobin (1958) for this model is consistent. The likelihood function of the model (4) is given by L as follows:

$$L = \prod_0 F_i(g_{0i}) \prod_1 F_i(g_i) \qquad \text{.....(7)}$$

$$L = \prod_0 \left[\left[1 - F\left(\frac{Z_i \alpha}{\delta}\right) \right] \prod_i \frac{\delta^{-1} f[(g_i - Z_i \alpha)]}{\delta} \right] \qquad \text{.....(8)}$$

where *f* and *F* are the standard normal density and cumulative distribution functions, respectively. Then we can write the log-likelihood function as:

$$LogL = \sum_0 \log\left(1 - F\left(\frac{Z_i \alpha}{\delta}\right)\right) + \sum_1 \log\left(\frac{1}{(2\prod \delta^2)^{\frac{1}{2}}}\right) - \sum_1 \frac{1}{2\delta^2 (g_i - \alpha Z_i)^2} \qquad \text{.....(9)}$$

The parameters α and δ are estimated by maximizing the log-likelihood function:

$$\frac{\partial logL}{\partial \alpha} = -\sum_0 \left(\frac{Z_i f(Z_i\alpha)/_\delta}{1-F\left(Z_i\alpha/_\delta\right)} \right) + \frac{1}{\delta^2}\sum_1 (g_i - \alpha Z_i) Z_i = 0 \quad ..(10)$$

$$\frac{\partial logL}{\partial \alpha} = -\sum_0 \left(\frac{Z_i f(Z_i\alpha)/_\delta}{1-F\left(Z_i\alpha/_\delta\right)} \right) + \frac{1}{\delta^2}\sum_1 (g_i - \alpha Z_i) Z_i = 0 \quad ..(11)$$

Since the two equations (7) are non-linear, the maximum likelihood estimator must be obtained by an iterative process (Ricker-Gilbert *et al.,* 2011).

The double-hurdle model allows for the possibility that the probability of SHSCF to access FO's input credit and its intensity are influenced by different independent variables (Sinyolo *et al.,* 2017). Thus, the double-hurdle model is explained by the following equations:
First Hurdle (Access to FO's input credit).

The probability that SHSCF will access FO's input credit is hypothesized to be influenced by an underlying response variable that explains the farm characteristics, farmers characteristics, and institutional characteristics. The underlying response variable, denoted by g^*, can be expressed by the following regression equation:

$$g_i^* = x_i'\beta + \varepsilon_i \quad \text{…....…(12)}$$

g^* is the latent extent of utility that SHSCF will get when he/she access FO's input credit and the error term is assumed to be independent and normally distributed, i.e., $\varepsilon^i \sim N(0,1)$, and:

$g_i = 1 \; if \; g_i^* > 0$ g_i=1 if g_i^*>0 ……(13)

$g_i = 1 \; if \; g_i^* \leq 0$ g_i=1 if g_i^*≤0 ……(14)

The variable g_i takes the value of 1 if the SHSCF access FO's input credit and the marginal utility from access to FO's input credit is greater than not to access to FO's input credit, and zero otherwise. The binary variable of SHSCF to access to FO's input credit g_i is assumed to follow the probit model and is specified as follows:

$$\Pr(g_i = 1 \mid x_i)' = \Phi(x\beta) + \varepsilon_i \quad \text{.....…..(15)}$$

Where;
Pr = The probability of SHSCF to access FO's input credit
g = The binary variable of SHSCF to access FO's input credit
Φ = The cumulative normal distribution
x = The vector of a farm characteristics, farmers characteristics, and institutional characteristics
β = The coefficients to be estimated
ε_i= The random error term to be distributed normally with mean zero and unit variance. Second Hurdle (Amount of input credit accessed)

The access to FO's input credit intensity g^*, is assumed to have a truncated normal distribution with parameters that vary freely from those in the probit model, estimated by the following regression equation:

$$g_i^* = x_i'\alpha + \mu_i \quad \text{……(16)}$$

Where;
g_i^* = The observed intensity of access to input credit measured by the total amount of input credit obtained by SHSCFs from FO, for the farming season under study.
x_i= The vector of a farm characteristics, farmers characteristics, and institutional characteristics.
α = The estimated parameters
μ_i= The error terms

Based on the assumption of independence of the two error terms, Amore and Murtinu, (2021) suggested the first and second hurdles to be estimated using the maximum likelihood method of probit and truncated regressions, respectively. The independent double-hurdle model analysis was performed hypothesizing that the two error terms from the two hurdles are normally distributed and uncorrelated. In addition, variance inflation factor (VIF) was used with the tolerance level defined by 1/VIF to check for the degree of multicollinearity among the variables. In addition, the Breusch-Pagan/Cook-Weisberg was used to check if the error variance has non-constant variance (heteroscedasticity).

Results

Results for Inferential analysis

Table 1 shows the results for inferential statistical analysis. It has been observed that SHSCFs who access FOs' input credit and those who did not access FOs' input credit differ significantly in some factors. For example, the study revealed that, on average, SHSCFs who access to FOs' input credit have large farm size than those who did not access FOs' input

credit. Furthermore, the study indicates that, on average, SHSCFs who access FOs' input credit applied more improved seeds and pesticides compared to those who did not access FOs' input credit.

Furthermore, the analysis shows that, on average, SHSCFs who access FOs' input credit have high income and live far from the factory than those who did not access FOs' input credit. Moreover, SHSCFs who did not access FOs' input credit are on average less likely to get extension services than those who access FOs' input credit. SHSCFs who access FOs' input credit used lower labor cost compared to those who did not access FOs' input credit. Lastly, SHSCFs who access FOs' input credit have higher education level compared to those who did not access FOs' input credit. On the other hand, equipment cost and sex of male SHSCFs were insignificant related to both SHSCFs who access FOs' input credit and SHSCFs who did not access FOs' input credit.

Determinants of access to FO's input credit and its intensity among SHSCFs in Kilombero valley

Specification test

The study used robust standard error in the analysis to correct the problem of presence of heteroskedastic. Furthermore, the study conducted multicollinearity test to check presence of linear relationship among independent variables by using Variance Inflation Factor (VIF). The study found that, VIF value range from 3.423 to 3.672 which is less than 10, indicating the absence of multicollinearity among explanatory variables. Moreover, in testing the goodness of fit of the model, the study found that the value of Pseudo R-squared estimated is 0.5244 implying the estimated model explain the dependent model better than the model with no regressors by 52.44 percent. Therefore, the models were good for estimation of determinants and extent of access to FO's input credit among SHSCFs.

Table 1: Results for Inferential statistics

Variables	Access to FOs' input Credit	No Access to FOs' input Credit	P-values
Farm size [hectare]	9.120	4.429	0.000*
Labour cost [TZS]	5057831.33	1885209.42	0.000*
Equipment cost [TZS]	553253.01	472356.02	0.371
Improved seeds [kilogram]	37.66	18.72	0.000*
Inorganic fertilizer [kilogram]	11124.40	2288.25	0.000*
Pesticide [litre]	18.78	9.15	0.000*
Sex of SHSCFs [male]	49.80	47.18	0.479
Age of SHSCFs [years]	1.18	1.20	0.019*
Income of SHSCFs [TZS]	10445612.64	4849139.64	0.000*
Distance to the factory [kilometer]	18.55	15.98	0.009*
Membership experience [years]	14.90	10.65	0.047*
Education level [Primary School]	0.833	0.719	0.025*
Get Extension Services [yes]	0.45	0.27	0.000*
Observations	83	191	

Notes: *The second and third column indicate proportions or mean values of the variables for SHSCFs who access input credit and who did not access input credit, respectively.*

Determinants of access to FO's input credit among SHSCFs in Kilombero valley

The first stage of double-hurdle was to examine the determinants of access to FO's input credit among SHSCFs. Based on the model, the possibility of SHSCF to access FO's input credit was determined by farm characteristics (farm size, labor cost, equipment cost, inorganic fertilizer, pesticides, and improved seeds), farmer characteristics (gender of SHSCFs, age of SHSCFs, income of SHSCFs and level of education of SHSCFs) and institutional characteristics (extension services, number of years SHSCF being a member of FO, and distance from farm to the factory).

The study found that a mixture of characteristics, one farm characteristic (farm size), two farmers' characteristics (age of SHSCFs and level of education of SHSCFs), as well as two institutional characteristics (number of years SHSCF being a member of FO (membership), and distance of a farm from the factory) significantly determined SHSCFs access to FO's input credits (Table 2). With age having significantly negative correlation with access to FO's input credits. Furthermore, the study found that labor cost, equipment cost, inorganic fertilizer, pesticides, improved seeds, gender of SHSCFs and extension services having no significant influence on SHSCFs decision on accessing FO's input credits (Table 2). With labour costs, equipment costs, improved seeds and income of SHSCF indicating negative correlation.

Determinants of input credit access intensity among SHSCFs in Kilombero valley

The second stage of double-hurdle was to examine the determinants of amount of FO's input credit accessed among SHSCFs. Based on the model, the probability of SHSCF to access certain amount of FO's input credit was also determined by farm characteristics (farm size, labor cost, equipment cost, inorganic fertilizer, pesticides, and improved seeds), farmer characteristics (gender of SHSCF, age of SHSCF, family size, income of SHSCF, level of education of SHSCF), and institutional characteristics (extension services, number of years of SHSCF being a member of FO (membership), and distance from farm to the factory).

Table 2: Maximum Likelihood estimates of double-hurdle for determinants of access to FO's input credit among SHSCFs in Kilombero valley

Number of Obs. = 274 LR chi² (13) = 44.07
Prob > chi² = 0.0000 Log likelihood = -146.01608
Pseudo R^2 = 0.5244 Outcomes correctly predicted = 79.81

Variables	Coefficient	Marginal Effects	Robust Std. Err.	Z	P>|z|
Farm size	0.046	0.016	1.047	3.14	0.005*
Labour cost	-0.537	-0.181	0.602	-0.89	0.373
Equipment cost	-0.055	-0.018	0.109	-0.51	0.614
Inorganic fertilizer	0.033	0.011	0.093	0.35	0.726
Pesticide	1.036	0.349	0.465	0.68	0.498
Improved seeds	-0.081	-0.027	0.556	-1.12	0.263
Gender of SHSCF	0.027	0.009	0.270	0.10	0.921
Education Level of SHSCF	0.109	0.037	0.161	3.25	0.004*
Get Extension Services	0.415	0.144	0.185	1.24	0.125
Age of SHSCF	-0.506	-0.170	0.379	-3.33	0.003*
Income of SHSCF	-0.123	0.041	0.110	-1.42	0.072
Distance to the factory	-0.080	-0.027	0.163	-2.25	0.023*
Membership	0.136	-0.046	0.144	1.94	0.047*

Notes: ** denote 5% significance level*

The study found that credit access intensity was significantly influenced only with farm characteristic (inorganic fertilizer) and institutional characteristics, which were number of years of SHSCF being a member of FO (membership), and distance from farm to the factory (Table 3). Similarly, none of the farmers' characteristics had significant influence of the intensity access. Furthermore, the study found that labor cost, equipment cost, farm size, pesticides, improved seeds, age of SHSCF, extension services, gender of SHSCF, family size, income of SHSCF and level of education of SHSCF statistically do not have significant influence on the amount to be accessed from the FO's input credit by SHSCFs.

suggest that smallholder farmers with small size of farm are more likely to have repayment problems compared to the smallholder farmers with large size of farm.

Also, the result shows that, SHSCFs with primary education has lower probability of access FO's input credit. This could be attributed to high degree of financial literacy as the more educated the smallholder farmer is, the more skills and knowledge is attained in management and financial matters. These findings are consistent with that of Isaga (2018) who also found that education is a significant determinant of smallholder farmers' input credit access. The education level of smallholder farmer affects the probability of access to input credit.

Table 3: Maximum Likelihood estimates of double-hurdle for determinants of access to FO's input credit intensity among SHSCFs in Kilombero valley

Wald chi² (13) = 44.77

Variables	Coefficient	Robust Std. Err.	Z	P>|z|
Farm size	-0.440	1.096	-0.40	0.688
Labour cost	-0.378	0.678	-0.56	0.577
Equipment cost	0.183	0.113	1.61	0.107
Inorganic fertilizer	0.202	0.093	2.16	0.031*
Pesticide	-0.131	0.506	-0.26	0.796
Improved seeds	1.309	0.685	1.91	0.056
Gender of SHSCF	0.413	0.319	1.29	0.195
Education Level of SHSCF	-0.017	0.175	-0.10	0.924
Get Extension Services	0.003	0.195	0.01	0.988
Age of SHSCF	0.513	0.451	1.14	0.255
Income of SHSCF	-0.025	0.122	-0.21	0.835
Distance to the factory	-0.515	0.197	-2.62	0.009**
Membership	-0.443	0.221	-2.01	0.045*

***Notes:** *, ** denote 5% and 1% significance level respectively*

Discussion

Determinants of access to FO's input credit and its intensity among SHSCFs in Kilombero valley

Determinants of access to FO's input credit among SHSCFs in Kilombero valley

Farm size found to be positive influence SHSCF to access FO's input credit. This means that the increase in one acre of farm led to the increase in the probability of SHSCFs to access FO's input credit. Similarly, Aguilera and Gonzalez-Vega, (2019) and Drisu *et al.,* (2019)

Furthermore, the study found that, with one year increase in the age of SHSCF, the probability of access to FO's input credit decreases. This implies that the younger SHSCF who tend to be more risk neutral are expected to have access to input credit than the older SHSCF. The result was equivalent to the previous studies of Tura *et al.,* (2017) and Samson and Obademi, (2018) which reported that farmers with access to input credit from agricultural input providers face the problem of aged farmers comparably to young farmers in information asymmetry at a low level

on the prices of agricultural inputs.

Moreover, the findings show that, distance from the farm to the factory have negative related with probability of SHSCF to access FO's input credit. This means that, when distance from the farm to the factory increases by one kilometer, the probability of SHSCF to access FOs' input credit decreases. This is due to the fact that, FOs in Kilombero provide input credit services to farmers who are not in more than 40km from the factory. So, when the kilometers from the farm to the factory increase, farmer decrease probability of receive FOs services including accessing to input credit. These findings were equivalent to Drisu *et al.,* (2019) and Nwandu, (2021) who revealed that the distance between lender and borrower is an important factor in terms of influencing access to input credit for smallholder farmers.

Lastly, the finding indicated that number of years of SHSCF being a member of FO (membership) have statistically significance influence probability of SHSCF to access FO's input credit. The result shows that, years which SHSCF spent being a member of FO have positive relation to the probability of SHSCF to access FO's input credit. This means that, with a one-year increase of SHSCF being a member of FO, the probability of access to FO's input credit increases. The study was in line with Bernard et al., (2018) who revealed that farmers with many years of being a member of FO are more likely to avoid mistakes when request to access input credit than those with no few years.

Determinants of input credit access intensity among SHSCFs in Kilombero valley

Moreover, the study revealed that amount of inorganic fertilizer found to be positive influence amount of FO's input credit a farmer will be likely to obtain. This means that the increase in one kilogram of amount of inorganic fertilizer led to the increase in the probability of obtain high amount of FO's input credit. The study was supported by Bernard et al., (2018) who revealed that farmers with who use large amount of inorganic fertilizer are more likely to access higher amount of input credit than those who use small amount of inorganic fertilizer.

In addition, the study found that distance from the farm to the factory have negative related with amount of FO's input credit a farmer will be likely to obtain. This means that, when distance from the farm to the factory increases by one kilometer, the probability of getting high amount of FO's input credit decreases. This result was in line with that of Isaga (2018) who also revealed that farmers who have farms far from factory have lower probability of access high amount of input credit compared to the farmers who have farms near the factory.

Nevertheless, the result shows that, number of years which SHSCF spent being a member of FO have negative relation to the probability of getting high amount of FO's input credit. This means that, with a one-year increase of SHSCF being a member of FO, the probability getting high amount of FO's input credit decreases. In other words, the more the years SHSCF being a FO member, the lower the amount of FO's input credit a farmer will be likely to obtain. Similarly, Drisu *et al.,* (2019) suggest that farmers experience have negative relationship with the amount of input credit to be accessed by farmer.

Conclusion

The current study examined determinants of access to FOs' input credit and its intensity among SHSCFs by using double-hurdle model. The study found that farm size, age of SHSCF, level of education of SHSCF, income of SHSCF, number of years of SHSCF being a member of FO (membership) and distance from farm to the factory to be important factors in determining the probability of smallholder farmers to access FOs' input credit. Furthermore, the study found that inorganic fertilizer, number of years of SHSCF being a member of FO (membership), and distance from farm to the factory was to be important factors in determining the amount of FOs' input credit to be accessed by smallholder farmers, and that farmers' characteristics has no influence in determining the intensity of credit to be accessed.

Based on the above, policy efforts for enhancing access to FOs' input credit should be promoted to remedy the problem of limited access to FOs' input credit. This is especially critical now that Tanzanian through the ministry

of agriculture and other agricultural stakeholders should create implicated policy in among other things policies that reduces hardship in the provision of input credit in agricultural inputs. This should be the priority to the government and other agricultural stakeholders. The government also should strengthen FO (membership) to build a collective action, efforts, knowledge, and strength of the group' combined resources to attain a shared interest of all members. However, these findings should be cautiously interpreted in light of limitations of the cross-sectional design, based on which we cannot claim with certitude that the observed relationship is causal. In this vein, a longitudinal study may offer a better option for causal-effect analysis.

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