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Drivers of Access to Credit Among Smallholder Farmers in Uganda: Application of Binary Logistic Model

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This study aimed at determining the drivers of access to credit among smallholder farmers in Uganda. Using a cross-sectional survey, data were collected from 374 farmers in Jinja district, followed by data analysis using descriptive statistics and Binary logistic regression model. Additionally, we used Chi-square and t-test to compare farmers with and without access to credit. The results showed that 62.83% of the farmers had access to credit. Additionally, farmers with access to credit were generally better off than those without access to credit. Having a mobile phone ($p < 0.01$), group membership ($p < 0.01$), access to extension ($p < 0.05$), farm size ($p < 0.01$) and distance to the market ($p < 0.05$) had a positive and significant effect on credit access while non-farm income ($p < 0.05$) showed an inverse relationship with credit access. To increase credit access among the smallholder farmers, farmers should be encouraged to purchase mobile phones and join groups where they would disseminate information on the various source of agricultural credit. Extension workers should also make effects of reaching all the farmers and training them on ways of accessing agricultural credit.

Keywords:

Credit Access,
Binary Logistic,
Low Productivity,
Agriculture,
Uganda

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INTRODUCTION

In Uganda, agriculture has played a significant role in economic development, food production and employment creation (Diao et al., 2010; FAO, 2002, 2005; Imam & Kushwaha, 2013; Mozumdar, 2012; Pawlak & Kołodziejczak, 2020). It contributes approximately 24.03% of the total gross domestic product (FAO, 2018). In addition to this, this sector has employed over 25% of the population (MAAIF, 2020). However, agricultural productivity in Uganda has not reached its potential yield. Specifically, this sector is at 40% of its productivity potential (Fiala & Apell, 2017). Reportedly, maize yield in 2006 was 551 kg/ha against the 5,000-8,000 kg/ha optimal yield, beans had an average yield of 358 kg/ha against the 2,000-4,000 kg/ha optimal yield, groundnuts had a mean yield of 636 kg/ha against the 2,700-3,500 potential yield while banana and coffee reported a yield gap of 58% and 89% respectively (Epule et al., 2018; FAO, 2021; Kraybill et al., 2012; Okello et al., 2019; Water et al., 2015). This implies that agricultural productivity in Uganda is indeed declining. The declining productivity may have been attributed to many factors including inability of smallholder farmers to adopt new agricultural technologies, use certified seeds, purchase farm inputs at the right time for production due to financial constraints among the farmers (Amanullah et al., 2020; Khanal & Omobitan, 2020; Komicha & Ohlmer, 2007).

Access to agricultural credit has been found to be one of the solutions to increasing farm productivity (Moahid et al., 2021). When farmers have adequate access to agricultural credit, they are able purchase the right and recommended inputs for their farms, adopt agricultural technologies that boost farm yields, and use certified seeds plus other farm

resources needed to increase farm productivity (Jimi et al., 2019). Nevertheless, agricultural credit helps farmers to form groups including savings groups where they can share production ideas, disseminate information amongst and organize farm workshops and trainings that help to increase farm productivity. It also increases the efficiency of farm productivity (Komicha & Ohlmer, 2007).

Existing literature has shown that there are different ways that farmers can access agricultural credit. These includes the formal and informal sources. Adebayo & Adeola (2008) reported that the main source of credit for smallholder farmers in Oyo State, Nigeria was the informal sources such as farmers cooperatives which provides quick loans to farmers as well as helping them save. On the other hand, Saleem (2008) reported that the common source of agricultural credit among Dera farmers was commercial banks providing agricultural loans for purchasing farm inputs. Farmers can also borrow finances from their friends and relatives then later repay it after the sales depending on the agreement as reported by Ijioma & Osondu (2015). Based on the cited studies, sources of agricultural credit are many and can be categorized into formal and informal sources. Even though agricultural credit plays a significant role in the lives of smallholder farmers, the drivers of access to credit have not been adequately studied in Uganda. As such, this study was guided by the following research questions: 1) What is the proportion of farmers with access to credit in Uganda? 2) What are the drivers of access to credit among smallholder farmers in Uganda? The results obtained in this study will provide recommendations aiming at increasing access to credit so as to increase farm productivity among smallholder farmers. This, in the long run, will help in increasing household food production.

MATERIALS AND METHODS

Study Area

This study was done in Jinja district in Uganda. This district is located in the Eastern part of Uganda. It is approximately 81 kilometres away from Kampala, the capital city of Uganda. Additionally, it is located on 0° 35' 59.99" N latitude and 33° 11' 60.00" E longitude. This district has a population of 471,242 persons, of which 51.2% are females while the rest are males. This district has a total of 3 counties, 6 sub-counties, 46 perishes, 381 villages and 105,358 households which depend on agriculture as their main economic activity (UBOS, 2017). The main crops grown in this district include cassava, maize, beans, groundnuts, millet, yams, cow peas, and cotton. Other significant economic activities include tourism, hotels, boutique, and fishing (UBOS, 2017).

Sampling

This study adopted multistage and random sampling techniques. After the purposive selection of Jinja district due to the high number of cassava producers, we again purposively selected four perishes for the study. These included; Budondo, Busedde, Butagaya, and Buwenge perishes. These four sub-counties were selected due to the high number of households (UBOS, 2017). Finally, simple random sampling was used to select 374 smallholder farmers. This sample size was arrived at following the formula below;

Sample Size Determination

The sample size for this study was determined following the formula developed by Cochran (1963) shown below:

$$n = \frac{Z^2 P(1 - P)}{e^2}$$

$$n = \frac{1.96^2 \times 0.58(1 - 0.58)}{0.05^2} = 374$$

n represent the sample size of the population, Z is the z-statistic from the statistical tables, for this study we will use a 95% confidence level, which represent 1.96. e represent the margin of error at 0.05 precision level and P represent the population

proportion which is estimated to be 0.58 (UBOS, 2018). The study obtained a sample size of 374 farmers.

Data Sources

Data collection tool was first developed for pretesting. This was followed by pretesting of the tool on 25 farmers in Gulu to test for the clarity, validity, and reliability of the tool. Fortunately, the pretested questionnaire showed clear, reliable, and accurate results. Primary data were then collected from the 374 cassava producers using the pretested semi-structured questionnaire on a cross-sectional survey from 10th to 25th November 2021. The data collection tool focused on variables such as age, gender, farming experience, distance to the nearest markets, education, household size, farm size, access to extension services, access to credit, group membership, crop yields, number of mobile phones, non-farm income among others. Data collection involved interviews between the research assistants and the farmers.

Data Analysis

This study characterized farmers who had access to credit and those who had no access to credit using t-test and Chi square test. The results were then presented in tables using means for the continuous variables and proportions for the categorical variables. Additionally, in order to determine the drivers of access to credit among cassava producers, this study employed Binary logistic regression model. This model was selected because the dependent variable was binary. Farmers who had access to agricultural credit were coded as 1 while those who did not have access to agricultural credit were coded as 0. According to Jaza et al. (2018), the probability of having an access to credit is specified in the equation 1 below;

$$\Pr(Y = 1) = \phi\left[\sum_{k=1}^k \beta_k X_k\right] \quad (1)$$

On the other hand, according to Aryal et al. (2020), the probability of not having access to credit specified in equation 2 as;

$$\Pr(Y = 0) = 1 - \phi\left[\sum_{k=1}^k \beta_k X_k\right] \quad (2)$$

According to Endalew & Yenewa (2021) and Jegede (2020), binary logistic regression model is specified in equation 3 as;

$$\text{logit}(P) = \ln\left(\frac{p}{1-p}\right) = \beta_0 + \beta_i X_i + U_i \tag{3}$$

Where; P represents the probability of having access to agricultural credit, β_0 represents the constant term, β_i represents the regression coefficient to be determined, X_i represents the explanatory variables presented in table 1 below while U_i is the error term assuming a normal distribution. Marginal effects were then determined by differentiating equation 2 above with respect to X_k as illustrated in equation 4 below;

$$\frac{\partial Pr(Y=1)}{\partial X_k} = \phi\left[\sum_{k=1}^k \beta_k X_k\right] \times \beta_k \tag{4}$$

Literature Review on the Study Variables

The study variables presented in table 1 below were obtained and hypothesized based on the reviewed

literature. It clearly outlines the determinants of access to agricultural credit based on the literature. For instance, a recent study done by Zulfiqar et al. (2021) aiming at determining the determinants of access to agricultural credit in Pakistan reported that education and farm size had a positive effect on access to agricultural credit while age, distance and off-farm income showed an inverse relationship with access to agricultural credit. Similarly, Ray (2020) reported that the major factors affecting access to agricultural credit among farmers in Pakistan included farm size, marital status, education level and farm status. Additionally, Saqib et al. (2018) reported a positive effect of education level, land holdings, farming experience, land owned and family size and an inverse effect of monthly income on farmers access to agricultural credit. Other studies on the determinants of credit access among farmers include Assogba et al. (2017); Moahid et al. (2021); Sekyi et al. (2020); Zulfiqar et al. (2021).

Table 1: Study variables

Variables	Measurement	Expected sign
Dependent variable		
Access to agricultural credit	1- Access, 0-Otherwise	
Independent variables		
Household size	Number	±
Farmers' age	Years	±
Farmer has mobile phone	1-Has a mobile phone, 0-Otherwise	+
Group membership	1-Member, 0-Otherwise	+
Access to extension services	1-Access, 0-Otherwise	+
Farm size	Acres	+
Market distance	Kilometres	±
Farmer has non-farm income	1-Has non-farm income,0-Otherwis	-

RESULTS

Access to and Source of Credit

The results depict that out of the 374 sampled farmers, 235 farmers (62.83%) had access to credit while 139(37.17%) did not have access to agricultural credit. This implies that indeed the

number of farmers who has access to credit has not reached the optimal.

Table 2 presents the sources of credit for the farmers. Based on the results, the farmers presented four major sources of credit. These included village savings and loans associations (VSLA), Saccos, financial institutions which includes banks & microfinance, and friends & relatives. Majority of

the farmers (50.27%) sourced their credit from the VSLAs while only 3.48% of the farmers borrowed from the friends and relatives.

Table 2: Sources of credit

Source	Number of farmers (f)	Percentage (%)
Village savings and loans associations	188	50.27
Friends and relatives	13	3.48
SACCOs	14	3.74
Financial institutions	20	5.35

Comparison of Farmers With and Without Access to Credit

Table 3 compares the farmers who had access to credit and their counterparts who did not have access to credit. The mean age of the farmers was 42.90 years. There was no significant difference in the age between the farmers who had access to

credit and their counterparts who did not have access to credit. At 1% level of significance, there was a statistically significant difference in the number of years spent in school between the farmers who had access to credit and their counterparts. Those who had access to credit spent a mean of 7.60 years in school while their counterparts spent a mean of 6.40 years in school. Generally, the farmers spent an average of 7.13 years in school.

Table 3: Comparison of farmers with and without access to credit

Variables	Pooled (N=374)	Has access to credit (N=235)	Do not have access to credit (N=139)	Mean difference (absolute)
Age (Years)	42.90 ± 14.00	42.8	43	0.22
Education (Years)	7.13 ± 3.50	7.6	6.4	1.20***
Family size (Number)	7.40 ± 3.40	7.26	7.51	0.25
Farm size (Acres)	2.36 ± 2.09	2.38	2.33	0.05
Number of mobiles (Number)	1.89 ± 1.25	2.05	1.65	0.40***
Access to extension (Has access)	0.63 ± 0.48	0.76	0.4	0.36***
Group member (Group member)	0.67 ± 0.47	0.86	0.35	0.51***
Farm output (Kilograms)	783.43 ± 243.50	881.1	618.28	262.82*
Uses inorganic fertilizer (Uses)	0.42 ± 0.49	0.51	0.28	0.22***
Hires labour in the farm (Hires)	0.63 ± 0.48	0.72	0.48	0.24***
Uses ox-plough (Uses)	0.36 ± 0.48	0.45	0.2	0.25***
Uses hybrid seeds (Uses)	0.34 ± 0.47	0.34	0.3	0.04***

*** and * means statistical significance at 1 and 10% respectively.

The mean family size was 7 family members. Again, there was no significant difference in the number of family members among the two groups. The farmers cultivated on 2.36 acres of land. There was no significant difference in farm size among the two groups. The farmers had a mean of approximately 2 mobile phones. However, farmers who had access to credit had significantly ($p < 0.01$) more mobile phones than their fellows who did not have access to credit, this implies that credit access

by the smallholder farmers increases assets acquisition. On average, 63% of the farmers had access to extension services.

There was a statistically significant difference in access to extension services among the two groups. 76% of the farmers who had access to credit had access to extension service while only 40% of the farmers who had did not have access to credit had access to extension services. At 1% level of

significance, there was a statistically significant difference in group membership among the two groups. Generally, 67% of the farmers were members to different groups. However, 86% of the farmers who belonged to different groups had access to credit while only 35% of the farmers who had no access to agricultural extension were group members. The farmers reported a mean yield of 783.43 kilograms, those with access to credit had significantly ($p < 0.10$) higher yields than their counterparts without access to credit.

The results clearly depict that 42% of the farmers used inorganic fertilizers in their farms. 51% of the farmers with access to credit used inorganic fertilizers while only 28% of those without access to credit used inorganic fertilizers in their farms. The difference was statistically significant at 1%. Similarly, 63% of the farmers used hired labour for various farm activities. The results further showed that there were significantly ($p < 0.01$) many farmers who had access to credit and used hired labour than those who did not have access to credit. Similarly, 36% of the farmers used ox-plough for land preparation, 45% of those who had access to credit used ox-ploughs for land preparation while only 20% of those without access to credit used ox-ploughs. Again, the difference in use of ox-plough among the two groups was statistically significant ($p < 0.01$).

Strikingly, only 34% of the farmers used hybrid seeds in their farms, however, at 1% level of significance, there were many farmers who had access to credit and used hybrid seeds than those who did not have access to credit. Based on the results from the above comparison, it is clearly evident that farmers who have access to credit are better off than their counterparts who do not have access to credit. They reported higher education levels, higher yields, and more mobile phones. Additionally, majority of the farmers with access to credit were members to farmers' groups, had access to extension services, used hired labour, ox-plough, and hybrid seeds in their farms. As such, they generally reported higher yields than their counterparts who did not have access to credit.

Binary Logit Results for the Drivers of Access to Credit

The results from binary logistic regression model (depicted in table 4) presents the drivers of access to credit by the farmers. The model was significant at 1% level of significance with a pseudo-R squared of 0.2851, the value of the pseudo-R squared falls within the "Extremely good" category i.e., 0.20 – 0.40. The likelihood (chi2) ratio (LR) was 140.69 while the log likelihood value stood at -176.430 implying that the model was adequate enough to present the drivers of access to agricultural credit.

Table 4: Drivers of access to credit

Variable	Coefficient	Std errors	Marginal Effects	Std errors
Household size	-0.039	0.043	-0.008	0.009
Farmers' age	0.025	0.443	0.005	0.096
Farmer has mobile phone	1.232***	0.466	0.294***	0.111
Group membership	2.200***	0.302	0.486***	0.059
Access to extension services	0.700**	0.297	0.155**	0.066
Farm size	0.584***	0.186	0.126***	0.038
Market distance	0.411**	0.200	0.089**	0.043
Farmer has non-farm income	-1.005**	0.512	-0.239**	0.125
Constant	-2.639	1.721	----	-----

*LR chi2(8) = 140.69, Pseudo R² = 0.2851, Log likelihood = -176.430, Prob > Chi2 = 0.000 while N = 374. ** and *** denotes statistical significance at 5 and 1% respectively*

The results (Table 4) revealed that farmers who had mobile phones had 29.4% significantly ($p < 0.01$) higher probability of accessing credit than their counterparts, a situation implying that ownership of

mobile phones has a positive association with access to credit. Similarly, farmers who belonged to groups had 48.6% significantly ($p < 0.01$) higher probability of accessing credit than their

counterparts who were non-group members. Access to extension services showed a positive and significant ($p < 0.05$) effect on access to credit. Farmers who had access to extension services had a 15.5% significantly ($p < 0.05$) higher probability of accessing credit.

The size of the farm under crop production had a positive and statistically significant ($p < 0.01$) effect on access to credit. Specifically, increasing the size of the land by a unit would result into an increase in the probability of accessing to agricultural credit by 12.6%. The results further depicted a positive and statistically significant ($p < 0.05$) association between access to credit and distance to the nearest market. A unit increase in the distance to the nearest market would result into an 8.9% increase in the probability of accessing credit by the farmers. As hypothesized, non-farm income showed a negative and statistically significant ($p < 0.05$) effect on access to agricultural credit. Farmers who had non-farm income had 23.9% significantly ($p < 0.05$) lower probability of accessing credit than their counterparts who did not have non-farm income.

DISCUSSION

The results showed that out of the sampled farmers, 62.82% had access to agricultural credit. Even though this is better than the previously reported proportion by Sekyi et al. (2020), it is quite unfortunate that not all the farmers had access credit, a situation which does not guarantee maximum agricultural productivity. This proportion is higher than the one reported by Sekyi et al. (2020), who reported that only 30.25% of the smallholder farmers in Ghana had access to agricultural credit. A further analysis for comparing the farmers with credit and their counterparts without credit clearly revealed that having access to credit is beneficial to farmers in many ways. For instance, we found out that farmers who had access to credit could join groups easily than their counterpart because they could meet the financial requirements of joining the groups. Similarly, farmers who had access to credit had more mobile phones than their counterparts, this further implies that indeed agricultural credit helps in asset acquisition. A similar pattern was also observed in access to extension services. Having more mobile

phones enabled farmers to coordinate easily with the extension agents resulting into credit access. Nonetheless, majority of farmers with access to credit used hybrid seeds, inorganic fertilizer and ox-ploughs in their farms resulting into increased yields than their counterparts without access to credit.

Farmers reported four major sources of credit. These included both formal and informal sources. The formal sources included financial institutions and Saccos while other informal sources on the other hand included borrowing from friends, relatives and Village Savings and Loans Associations. From these sources, majority of the farmers reported that the main source of credit was the Village Savings and Loans Associations. This also depicts that these associations are beneficial to the smallholder farmers in terms of savings and borrowing and finances. As such, farmers should be encouraged to join them.

On the drivers of access to credit, this study found a positive and significant effect having mobile phone on access to credit. Mobile phones have become the common mode of communication in the current world. As such, farmers who have mobile phones could easily coordinate with the credit institutions easily than their counterparts who did not have mobile phones. With good communication and coordination, among the farmers and the financial institutions farmers would access credit easily. Additionally, farmer with mobile phones could access short term loans from their phones. This is in agreement with the findings revealed by Zulfiqar et al. (2021).

Group membership had a positive and significant association with access to credit. This was attributed to the fact that as farmers join these groups, they are able to share and disseminate ideas relating to different sources of credit. Additionally, some of these groups may train farmers on the different sources of credit available to them. This increases access to credit. As such, farmers who join groups would access credit easily than their counterparts who are non-group members. This is in agreement with the findings reported by Sekyi et al. (2020), who found out that group membership has a significant effect on credit access among farmers in Ghana. Additionally, Assogba et al. (2017) reported that smallholder farmers who were group members

would access to credit easily than their counterparts who were non-group members in Benin. Similarly, the positive relationship between access to extension and access to credit was attributed to the fact that extension workers would teach the farmers on the ways of accessing credit. They would also encourage them to take agricultural loans at lower interest rates. This increases access to credit among the farmers. This is consistent to the findings reported by Moahid et al. (2021) who observed that extension services is one of the key strategies for increasing credit access among the smallholder farmers.

Similarly, farm size showed a positive and statistically significant effect on access to credit. As the size of the farm increases, the quantity of inputs used by the farmer also increases, a situation which needs more capital in order to produce. As such, farmers with large portions of land could look for sources of credit so that they could purchase additional inputs required for production similar findings were reported by Zulfiqar et al. (2021), who found out that farm size has a positive effect on access to credit among farmers in Pakistan. There was a positive and significant influence of distance to the market on access to credit. This was due to the fact that as farmers travel long distance, they become aware of the existence of other sources of credit which far away from them, however, Zulfiqar et al. (2021) reported that farmers located near the trading centres would access credit easily than their counterparts located far away from the trading centres. As hypothesized, the results reported an inverse relationship between access to credit and non-farm income. Farmers who had non-farm income had less probability of accessing credit. This is in line with the outcome reported by Zulfiqar et al. (2021).

CONCLUSION AND RECOMMENDATION

This study aimed at drivers the determinants of access to credit among cassava producers in Jinja district. As such, we collected data on 374 farmers using multistage and random sampling. The results showed that majority of the farmers (62.83%) had access to credit. They obtained credit mainly from VSLAs. The results further revealed that farmers who had access to credit were better off than their

counterparts who did not have access to credit. Specifically, they reported higher yields, higher education level, more mobile phones, and majority of them had access to agricultural extension and were group members. On the determinants of access to credit, this study found that having a mobile phone, group membership, access to extension services, farm size, and distance to the market had a positive and significant effect on access to agricultural credit while non-farm income had a negative and significant effect on access to agricultural credit among the farmers.

This study therefore concluded that the determinants of access to credit included mobile phone ownership, group membership, access to extension services, farm size, distance to the market and non-farm income. Based on the results, this study recommended that farmers should be encouraged to purchase mobile phones and join groups where they would disseminate information pertaining the sources of agricultural credit. Purchasing mobile phones will not only help them access information on access to credit but also increase the coordination between them and the extension agents which in the long run increases access to agricultural credit. Additionally, extensions workers should reach all the farmers and train them on the various sources of agricultural credit. Lastly, farmers should be encouraged to join groups which offer agricultural loans.

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