J. Agr. Sci. Tech. (2021) Vol. 23(4): 753-765

Factors Influencing Tea Farmers' Decisions to Utilize Sources of Credit in Nyaruguru District, Rwanda: A Multivariate Probit Regression Analysis

A. Kabayiza[1*], G. Owuor[2], J. K. Langat[2], and F. Niyitanga[1]

ABSTRACT

Credit is a major tool and an important factor for tea production and farm outcome. Its demand from different lending sources has been increasing to meet capital investment in the tea sector. Accessed credit is to meet costs of tea production, mainly fertilizers, seedlings, and labor as well. Factors affecting access to credit have been a subject of vast debate in recent studies that credit seekers obtain credits only when they are eligible by complying with the requirements set by lending institutions. However, literature has limited findings on the behavior of small-scale borrowers in selecting a credit source and inducing factors. In particular, borrowing arrangements necessitate the analysis to inform policy makers on needed adjustment in the lending system to improve tea production and sector development. The study aims at disclosing responsible factors to choose a particular credit source by smallholder tea farmers. A survey was conducted with 358 tea growers selected randomly in two cooperatives that operated in Nyaruguru District. A multivariate probit model was used for analytical analysis. Borrowing from formal source (commercial banks) increased if borrower possessed collateral asset (85.5%), interest rate (85.0%) size of tea plantation (24.8%) and household composition (10.5%). Using informal sources increased if a farmer desired a small credit (83.2%), participated in technical training (76.9%), and received joint credit (46.9%), while a farmer was likely to use less informal sources if his/her farm size (39.9%) and household income (29.2%) were small. However, combining sources of credit was used by farmers as a safeguard strategy to acquire the desired loan. A government policy, which aims to increase productive investment, should emphasize integrating agricultural loans in financial system targeting smallholder farmers through their organizations where they can relax credit constraints.

Keywords: Credit constraints, Formal loan sources, Government policy, Informal loan source.

INTRODUCTION

Tea and coffee are dominant cash crops since the colonial period (the 1930s) in Rwanda. Over the period, the two crops are still leading foreign earnings from agricultural exports (World Bank, 2019). The small-scale tea farmers own 70% of the total tea plantations and production of the processing tea factories depends on a daily supply of green tea leaves from these farmers (World Bank, 2013). Since 2013, the tea expansion program that integrates modern agricultural practices in Rwanda has required farmers to increase the capital to purchase farm inputs in order to meet the national export targets for the sector (MINICOM, 2013). Tea household farmers will need to increase the rate of fertilizer inputs, rehabilitation of the old tea plantations, increasing tea fields acreage, and to meet the cost for plucking and transportation of the produce to the processing factories. As a result, credit is a major tool and an important factor for tea production and farm outcome. Its demand from different lending sources has been increasing to meet

[1] Department of Rural Development and Agricultural Economics, University of Rwanda.
[2] Department of Agricultural Economics and Agribusiness Management, Egerton University, Kenya.
*Corresponding author; e-mail: akabayiza@gmail.com

[DOR: 20.1001.1.16807073.2021.23.4.9.8]

capital investment in the tea sector(Papias and Ganesan, 2010; NAEB, 2013).

The report of national institute of statistics of Rwanda (NISR, 2018) showed that lending statistics from available sources in the study area consist of formal, semi-formal, and informal sources and have provided credit to farmers with 4, 32.1, and 54.3%, respectively (NISR, 2018). MINECOFIN (2013) defines formal lending institutions as all regulated commercial and development banks. Semi-formal sources are microfinance banks that fall into four categories, namely, informal MFIs, SACCOs with collected deposits of less than 20 million Rwandan francs, limited companies or SACCOs with deposits over 20 million Rwandan francs, and non-deposit taking MFIs. Informal sources include farmers' cooperatives, Rotating Savings and Credit Association (ROSCA), inputs suppliers, private moneylenders, friends and relatives. The latter channelizes loans via community networks as they are operating in a very smallest radial of areas where participants know each other with more trust and mostly they carry out common activities with similar interests (Muhongayire, 2012). Tea cooperatives fall into category of informal sources where they provide non-cash credit for members as fertilizer inputs. Credit provided to members must be paid through deducting a certain amount upon supplying green tea leaves to the factories.

Factors affecting access to credit have been subject of vast debate in recent studies that credit seekers obtain credits only when they are eligible by complying with the requirements set by lending institutions. The literature on credit sources is of mixed analyses from different perspectives as a result of lending and borrowing conditions. The lending side is mostly regarded as the availability of lending institutions and their coexistence of being either formal, semi-informal or informal credit markets where interest rate differs greatly in these three markets (Boucher *et al.*, 2009; Kofarmata *et al.*, 2016). Studies argued that availability of financial institutions and lending system play an important role for borrowers to decide whether to utilize credit source or not. Factors viz., savings, level of the interest rate charged, possession of collateral, previous credit record, level of information displayed for credit products, and overall governance issues influence the behavior of borrowers among smallholder farmers(Salami and Arawomo, 2013; Deborah *et al.*, 2017).

As opposite to institutional factors, borrowing side is widely discussed to explain how socio-economic and farm characteristics of credit applicants as determinants of access to credit for the desired amount (Mgbakor *et al.*, 2014; Ijioma and Osondu, 2015; Gemere, 2017; Oshaji, 2018).

Empirical studies synchronously revealed that financial activities of the household farmers from formal sources are determined by mobilization of farmers into groups, off-farm incomes, collateral asset and education (Muhongayire, 2012; Moahid and Maharjan, 2020). On another side, lack of collateral asset, inflexibility in repayment arrangement systems, high borrowing costs, problems connected with disbursement time are mostly affecting credit access from formal financial institutions (Gobena and Jembere, 2016). Borrowing from informal sources are determined by mostly agricultural extension, community-based groups, trustful relationship with money lenders, size of credit that is relatively small and short term (Houseini *et al.*, 2012).

However, national statistics show the low rate of credit supply for agricultural projects from formal sources where microfinance institutions including SACCOs supplied about 15% while commercial banks supplied 1.6% in 2016 (BNR, 2017). The figures indicate that agriculture sector has been less attractive for formal lending institutions, in particular commercial banks, because of risks attributed to the sector (Augustin, 2012). To some extent, formal sources of credit act as a complement to the informal source because of the supply-demand gap in credit availability from informal sources (Adeagbo and Awoyinka, 2009). The informal sources take control of credit supply to smallholder farmers by reducing lending conditions because of access

[DOR: 20.1001.1.16807073.2021.23.4.9.8]

to keen information of business capacity and attitudes about borrowers that may increase trust for repayment (Diagne and Zeller, 2001; Kofarmata *et al.*, 2016).

In the time that demand for credit by tea farmers is crucial to respond to the need of investment at the desired level, low ratio reported on credit disbursed for smallholder farmers could discourage investment in the tea value chain, especially private tea factories that depend on daily supply of green tea leaves. Therefore, borrowing arrangements necessitate the analysis by inspecting the role of borrowers in choosing credit source and influencing factors to inform policy makers on needed lending system adjustment in the sector to increase tea production. Therefore, this study aimed to explore the factors influencing the choice of credit source among tea household farmers in Nyaruguru District, Rwanda.

MATERIALS AND METHODS

Data

The purpose of the study was to understand why tea farmers choose to utilize different sources of credit to meet tea production cost. Tea farmers from two cooperatives operating in Nyaruguru District who received credit, at least in the last three years up to 2018, are included in the analysis. The study considers both cash and no-cash credit accessed from different credit sources. Nyaruguru District was chosen purposively because its economy is based on agricultural activities mainly tea production. Tea is produced in ten (10) out of 14 sectors of the district. The district is implementing the national tea expansion program since 2012, which aimed at increasing tea production by increasing land size and inputs application to meet the national targets for the sector. Therefore, tea farmers had to access and use credit either in cash, in-kind, or both in the study area. Using the Yamane (1967) formula for a finite population, of the total 3,445 tea households grouped into two cooperatives, the data were collected by interviewing around 358 tea households selected randomly. Although the sampling was conducted in 2019 (September to November), the information about the credit utilization pertained to the three years ahead of that date (Fiscal year starts July 1st to June 30th of the following year, collected information pertained to the period from July 2016 to June 2019). Data collected were analysed using STATA version 16.

The Empirical Model

The multivariate model was used to account non-exclusive choices among alternative sources when borrowing (Greene, 2002). The multivariate model has been developed for econometric and statistical analyses to regress simultaneously multiple binary outcome equations (Cappellari and Jenkins, 2003). As tea farmers were not restricted to borrow from a single source of credit, the model allows correcting potential correlation of different sources while capturing unobserved disturbances (Cappellari and Jenkins, 2003; Tarekegn *et al.*,2017). The model has three dependent variables, namely, Y_1 (credit received from formal source), Y_2 (credit received from informal source), and Y_3 (farmer received credit from combined sources). These three dependent variables are dichotomous. Following standard treatment of dichotomous variables, the study assumes the existence of latent variables for the three corresponding dependent variables.

$$\begin{cases} Y_{1i}^{*} = x_{1i}\beta_1 + \varepsilon_{1i} \\ Y_{2i}^{*} = x_{2i}\beta_2 + \varepsilon_{2i}. \\ Y_{3i}^{*} = x_{3i}\beta_3 + \varepsilon_{3i} \end{cases} \quad (1)$$

For each dependent variable, the farmer's decision to utilize formal, informal, or combined sources is expressed, respectively, as follows.

$$Y_{1i} = \begin{cases} 1 \;\; if \;\; Y_{1s}^{*} > 0 \\ 0 \;\; Otherwise \end{cases} \quad (2)$$

$$Y_{2i} = \begin{cases} 1 \;\; if \;\; Y_{2s}^{*} > 0 \\ 0 \;\; Otherwise \end{cases} \quad (3)$$

$$Y_{3i} = \begin{cases} 1 \;\; if \;\; Y_{3s}^{*} > 0 \\ 0 \;\; Otherwise \end{cases} \quad (4)$$

[DOR: 20.1001.1.16807073.2021.23.4.9.8]

The model can estimate β_1, β_2, and β_3 jointly and the error terms conditionally follow a multivariate normal distribution, with zero mean and normal variance of one unit. Therefore, a matrix for symmetric covariance Ω (μ_1, μ_2, μ_3) MVN ~ (0, Ω) is given by:

$$\Omega = \begin{vmatrix} 1 & \rho x_1 x_2 & \rho x_1 x_3 \\ \rho x_2 x_1 & 1 & \rho x_2 x_3 \\ \rho x_3 x_1 & \rho x_3 x_2 & 1 \end{vmatrix}. \quad (5)$$

The matrix of covariance ρ_{is} is the pairwise of correlated coefficients of the error terms corresponding to choices and they should be estimated. The non-negative diagonal elements represent unobserved correlation in errors between multiple latent equations. In this way, the sign of ρ has information. A positive sign shows a complementary relationship of sources of credit, while a negative correlation means a substitution of sources of credits.

By following the formula of Cappellari and Jenkins (2003), the function of log-likelihood is specified as follows:

$$lnK = \sum_{i=1}^{n} \omega_i ln\delta(\theta_i, \vartheta) \quad (6)$$

Where, ω_i denotes optional weight for observation *i*, while δ_i is the standard normal distribution with θ_i *and* ϑ arguments. These last can be expressed follow:

$$\theta_i = (S_{1i}\beta_1 x_{1i}, S_{2i}\beta_2 x_{3i}, S_{3i}\beta_3 S_{3i} x_{3i}), \text{ while } \vartheta_{is} = 1 \ for\ j = S\ and \quad (7)$$

$$\vartheta_{js} = \Omega_{sj=} S_{ij} S_{is} \rho_{jk} \quad for\ j \neq S,\ S = 1,2,3 \quad with\ S_{is} = 2y_{is} - 1. \quad (8)$$

Where, *S* represents a Source of credit.

RESULTS AND DISCUSSION

Types of Credit Sources

The study has a prior assumption that tea household farmers could use different sources of credit by borrowing either from a single source or more than one and the choice might vary from one year to another. During the period considered for this study (2016-2018), tea farmers had obtained credit dedicated for from different lending sources. Therefore, the following analysis considered all the available sources in which farmers had approached for credit from both formal and informal sources during the aforementioned period.

Results show that tea farmers in the study area used formal and informal and in a different period, they could borrow from both sources of credit at, respectively, 31.3, 81.0 and 85.8% to meet their needs. The results agree with the findings that informal sources serve many farmers in the area which fall in our expectation (Papias and Ganesan, 2010). At the national level, the National Institute of Statistics of Rwanda (NISR) reported that 39.6% of the population had used formal mechanisms, 40.2% informal, while 32.6% used own mechanisms to meet the needs (NISR, 2012). By importance, informal sources include tea farmers' cooperatives, SACCOs, input sellers, tea factories, private moneylenders, friends and relatives. Formal sources include commercial and development banks. The study identified only two banks i.e. People' Bank of Rwanda (BPR) and Development Bank of Rwanda (BRD) that supplied credit to a few tea farmers. In most cases, tea farmers get credit from informal sources mostly upon presenting tea plantations or proof of membership from their respective cooperatives as a guarantee to obtain fertilizer inputs and equipment for tea plucking and transportation facilities.

Socio-Economic and Institutional Characteristics of Tea Farmers in Nyaruguru District

The results show that tea household farmers have not used microfinance institutions that fall into semi-formal sources. Besides, few of them have utilized less formal sources than informal sources with 31.5 and 81.0% respectively. Table 1 shows descriptive statistics of selected variables. Out of 358 household tea farmers interviewed, about 83% of households were headed by males while 17% were headed by females. The average age of household-head was 52 years. The results are in range with national information about the district (GOR, 2018) where male-headed households represented 73.2% with an average age of 51 years. The

[DOR: 20.1001.1.16807073.2021.23.4.9.8]

Table 1. Type of sources of credit and explanatory variables (n= 358)**.**

Variables	*Description*	Mean	Std dev
Dependent variables (Type of source of credit)			
Formal Source (FS)	Use of the formal source, 1= Yes and 0= 0therwise	0.31	0.46
Informal Source (IS)	Use of the informal source, 1= Yes and 0= 0therwise	0.81	0.39
Combination (CN)	Combined sources, 1= Yes and 0= 0therwise	0.86	0.35
Independent variables			
Age	Age of household head in years	52.1	11.83
Gender	1 if the head is male	0.83	0.38
Education	Years of schooling of the household head	5.72	4.27
Household size	Number of family members	6.10	1.91
Tea farm area	Size of owned tea plantation in hectares	0.56	0.83
Household tea income	Rwandan francs	590,512	977,886
Credit information	1 if the farmer had information about credit before borrowing	0.71	0.45
Collateral	1 if the farmer had a required collateral	0.61	0.49
Training on Credit management	1 if the farmer participated in training on credit management	0.24	0.43
Training on GAP	1 if the farmer participated in training on GAP	0.88	0.34
Group credit	1 if the farmer received joint/group credit	0.54	0.50
Credit Size	Amount of received credit in Rwandan francs	474,073	687,375
Distance	Distance to nearest formal lender institution	6.04	5.20
Interests rate	Nominal interest rate	0.04	0.03

household heads have had approximately 6 years of formal education that is at least the primary school level in Rwanda with average family members of 6 persons per family. It was also found that a household tea farmer averagely owns 0.56 hectares of tea plantation. The results showed that tea households averagely earned more income (590,512 Rwf) compared to the overall households' income in the district (488,988 Rwf) for the last three years.

The findings showed that around 71% of interviewed farmers had accessed to information about credit services from lending institutions before borrowing, and 61% of them possessed required collateral and mostly presented tea plantation that was preferred by creditors. Majority of tea farmers (88%) participated in training to increase their knowledge on good agricultural practices (GAP) of tea production provided by Tea Division, a department of the National Agricultural Export Development Board (NAEB) through their respective cooperatives.

It was found also that average of farmers who received joint credit accounted for 54% against 46% who received individual credit. Findings showed that they received 474,073 francs as the average credit size in the last three years. The interest rate was found to be low (average of 4%) as the majority of tea farmers borrowed from the informal sources where the charged interest rate was almost zero compared to the commercial banks.

Tables 2 and 3 show the test of mean differences for selected socio-economic and institutional characteristics across sources of credit used. The results show that factors influencing farmers' decisions vary and some were significant depending on the utilized source of credit. Factors such as tea plantation size, desired credit amount, interest rate and possession of required collateral value were significant across all

[DOR: 20.1001.1.16807073.2021.23.4.9.8]

Table 2. Association of socio-economic factors determining the choice of credit source.

Variables	Formal source users		Informal source users		Combined sources	
	Mean and Std dev	t-test	Mean and Std dev	t-test	Mean and Std dev	t-Test
Age	52.0	0.11	52.2	-0.19	52.2	-0.19
	(10.9)		(12.3)		(12.3)	
Education	5.3	-0.17	5.2	0.79	5.3	-0.69
	(4.1)		(4.3)		(4.3)	
Household size	6.5	2.39**	6.0	1.36	6.0	1.42
	(1.8)		(2.0)		(1.9)	
Tea plantation area (ha)	0.78	-3.45***	0.41	7.33***	0.50	3.45***
	(0.94)		(0.7)		(0.80)	
Distance (km) [a]	6.43	-0.95	6.0	0.60	6.03	0.08
	(5.81)		(5.03)		(5.08)	
Interest rate per month	0.06	-9.21***	0.04	6.16***	0.04	2.29**
	(0.04)		(0.02)		(0.03)	
Payback period [b]	12.79	0.51	12.3	2.78***	12.94	1.47
	(11.72)		(17.72)		(17.91)	
Amount of received credit	589,556.2	-2.16**	259,544.6	15.94***	334559.6	10.85***
	(843,717.8)		(246,830)		(435254.8)	
Household income	1,386,716	-0.23	1,229,999	4.89***	1277209	3.75***
	(1,209,838)		(977,930.8)		(1053412)	

[a] Distance to nearest lending institution; [b] The time between the first payment on a credit and its maturity, it was measured in number of months. *, ** and ***: Indicate statistical significance of mean difference at 10, 5 and 1% levels of significance.

Table 3. Association of institutional factors across the type of sources of credit utilized.

Variables	Formal source users		Informal source users		Combined sources	
	(%)	χ^2	(%)	χ^2	(%)	χ^2
Information on credit	34.51	4.2877**	78.82	2.7427*	83.92	2.4366
Group credit	29.17	0.8643	86.46	8.0014***	90.63	8.0415***
Collateral	47.03	65.0614***	81.01	9.9372***	85.75	5.8595**
Training on credit mgt	31.28	0.3756	81.01	1.1759	85.75	2.9540*
Training on GAP	31.28	0.0854	81.01	15.9541***	85.75	11.9075***

*, ** and ***: Indicate statistical significance at 10, 5 and 1% levels of significance.

sources of credit used. The size of tea plantation usually plays an important role in making borrowing decisions in the area as they provide a guarantee to both formal and informal lending institutions.

The credit size was significant (at 5% probability level) and negative for formal sources, while it was found to be significant (at 1%) and positive for informal sources and combination. This is because when farmers desire short term and a small amount of credit they prefer where the interest rate is low with flexible payback period (significant at 1%), and these are informal sources. With the same reason, around 81% of farmers preferred informal sources against 47% borrowed from formal sources. Two variables i.e. age and education were not found significant to influence farmers' decisions to borrow from any source of credit.

The level of household income, though less, was found more significant at 1% when borrowing from informal sources. This is due to the fact that informal lenders have access on keen information of business capacity, socio-economic status and attitudes about borrowers, which may increase trust for repayment and the similar reason was motivated by other related findings (Kofarmata *et al.*, 2016). However, the need

[DOR: 20.1001.1.16807073.2021.23.4.9.8]

for money to cover other household expenses, mainly schooling children, influences much to borrow from formal sources for large and long-term credit than borrowing from informal sources. The fact is that the loan to meet university fee for eligible students is only offered by the Development Bank of Rwanda (DBR). In such a situation, a household size with at least one person admitted to a university for studies is likely to borrow money to finance his or her studies. Similarly, with other related studies, some factors included in the current analysis such as age, education level of the household head, and distance to the nearest lending institutions were not significant to influence farmers' decisions across all types of sources credit (Mpuga, 2010; Nwaru *et al.*, 2011).

The results in Table 3 also show that only 34.5% of farmers who had information about credit services borrowed from a formal source, more significantly than those who borrowed from informal or choosing to combine sources. This is because to get credit from a formal source, the applicant must comply with a set of requirements established by the lending institutions. For this reason, the credit seekers should know about those requirements before proceeding to the application. This is different from the informal source, where a large number of farmers received credit in kind as fertilizers without even knowing details in the signed agreement between cooperative leaders and lending institutions on behalf of members. In this situation, farmers could combine sources of credit by borrowing from formal lending institutions (86.46%) while receiving a joint credit as fertilizers from either cooperative or input sellers (90.63%). It was found that borrowing from informal source alone (81.0%), and combining both formal and informal sources (85.8%) were significant if a farmer participated in training on Good Agricultural Practices (GAP) for tea production. However, participating in training on credit management did not affect farmers' borrowing decisions. With similar reason, the borrowing decision depends more on the applicant's needs and his repayment capacity than financial marketing approach used by lending institutions (Pishbahar *et al.*, 2015).

Results in Table 4 shows the Wald test and the maximum likelihood of multivariate estimations on the factors influencing farmers' decisions to utilize different sources of credit. The sources are defined as formal, informal and combined sources of credit. The Wald test [(χ^2 (42)= 192.38, P> Chi^2= 0.0000)] is significant (at P< 1%) to mean that the subset of coefficients is jointly significant in the model and the power of selected factors for the model is satisfactory. Likewise, the likelihood ratio test [LR (χ^2 (3)= 97.3888, P> Chi^2= 0.0000] for the independence of the terms of the residuals is strongly significant (at P< 1%), thus implying that different sources in their defined categories are not mutually independent. Therefore, if decisions to choose the three sources of credit are interdependent of tea household decisions, the multivariate model is supported to be used for modelling.

In Table (4), correlation coefficients matrix between error terms of the sources of credit are presented as reflected in likelihood ratio statistics. The formal and informal sources are negatively interdependent while informal and combination of both sources (formal and informal) are positively interdependent and significant (P< 1%). This can mean that a tea farmer who is using formal sources is less likely to utilize informal sources or combining sources. Similarly, a tea farmer who used informal sources was more likely to combine sources of credit. This indicates that farmers are more secured for credit from formal sources when they can also obtain credit from informal sources. However, when a farmer is unable to obtain credit from both sources, there is a competitive relationship of formal source with informal source among tea farmers.

[DOR: 20.1001.1.16807073.2021.23.4.9.8]

Table 4. Estimated correlation matrix of sources of credit from Multivariate Probit model.

	Formal source	Informal source	Combination
Formal source	1.0000		
Informal source	-0.2896***	1.0000	
Combination	-0.1024	0.9149***	1.0000

Likelihood ratio test of rho21= rho31= rho32= 0: $Chi^2(3)$= 97.3888 Prob> Chi^2= 0.0000
Number of observations= 358
Log likelihood ratio test= -302.81059
$Wald\ (\chi^2\ (42))$= 192.38, Prob> Chi^2= 0.0000***

*, ** and ***: Indicate statistical significance at 10, 5 and 1% levels of significance

The multivariate estimations in Table 5 show that some of the selected variables were differently significant at more than one source of credit, two were significant only for formal source, while three were significant for both informal and combined sources of credit. Household size has a positive relationship with the likelihood of choosing a formal source for desired credit at 5% levels of significant. Like in a different study (Bendig, *et al.*,2009), an increase in household size increased the probability of utilizing formal sources to get credit by 10.5%, when other factors are held constant. This implies that tea farmers with a large number of dependent members were more likely to borrow from formal sources such as commercial banks and microfinance institutions. The possible reason for this situation is the need of school fees for children in high schools and universities, which is ranked as the second after agriculture and livestock to allocate received loan, and health insurance that are important expenses for households in Rwanda (GOR, 2018).

Receiving credit in groups was positively significant (at P< 5%) and influencing farmers to get credit from informal source and combination of sources by 46.9 and 50.4%, respectively, when other factors are held constant. This implies that the collective responsibilities of cooperative members is likely and positively influencing the use of informal and combination sources. This is because group membership can be used as a

Table 5. Multivariate Probit estimations of factors influencing utilization of sources of credit.

Variables	Formal source		Informal source		Combined sources	
	Coefficients	SE	Coefficients	SE	Coefficients	SE
Age	-0.003	0.008	-0.001	0.009	0.008	0.009
Education	-0.008	0.022	-0.002	0.025	0.031	0.025
Household size	0.105**	0.047	-0.544	0.055	-0.020	0.052
Distance	-0.015	0.016	0.005	0.020	0.019	0.020
Payback period	-0.010	0.008	0.010	0.009	0.011	0.010
Info. about credit	-0.164	0.204	0.257	0.249	-0.056	0.229
Joint credit	-0.078	0.173	0.469**	0.206	0.504**	0.201
Collateral	0.855***	0.133	-0.098	0.141	0.249*	0.142
Training on credit mgt	-0.221	0.218	-0.027	0.229	0.014	0.224
Training on GAP	0.492*	0.297	0.769**	0.305	0.689**	0.276
Interest rate	0.850***	0.156	-0.127	0.097	0.116	0.099
Amount received credit	-0.131	0.088	-0.832***	0.120	-0.663***	0.115
Household income	-0.115	0.082	-0.292***	0.113	-0.214**	0.107
Tea plantation area	0.248**	0.100	-0.399***	0.112	-0.117	0.093
constant	1.087	1.528	15.218***	2.321	11.389***	2.171

*, ** and ***: Indicate statistical significance at 10, 5 and 1% levels of significance

[DOR: 20.1001.1.16807073.2021.23.4.9.8]

guarantee to informal lenders, and cooperatives can use this approach to get credit from even formal sources on behalf of members when approved by the general assembly. Having collateral asset was positively significant (at P< 5%) for formal source and 10% for combined sources. It means that borrowing from formal was likely increased by 85.5% and combined sources by 24.9% when other factors are held constant. The result agrees with the findings of the study of Mwendwa (2013). He showed that collate-able asset is mandatory for formal lending institutions mainly commercial banks and microfinance institutions whereas for other sources, it could require only to be a tea farmer and recognized by cooperative as a guarantee (Mwendwa, 2013).

The results revealed also that participating in training on good agricultural practices and maintenance of tea plantations was positively significant (at P< 10%) for formal sources and (P< 5%) for both informal and combination of sources. That is increased participation in one more training would lead to 49.2, 74.5, and 53.4% increase in using formal, informal, and combined sources, respectively. Technical training on good practices to maintain tea plantations were very important for farmers and level of tea production as it increased the farmers' knowledge and skills and they raised the need of credit to meet input costs for tea production (Owuor and Shem, 2012). In this way, inputs sellers supplying fertilizers in bulk through cooperatives become a priority to the choices of farmers to acquire inputs as credit that they usually payback upon supplying the produce to the factories. This implies that farmers prefer informal over formal sources as they could save credit-related costs, i.e., interest rate and disbursement time that would take to borrow from formal sources.

The coefficient for interest rate was positive and significant (at P< 1%) for only the formal source. The results showed that the interest rate charged was higher to borrow from formal sources than to borrow from informal sources. However, the conclusion could not be generalized because the received credit from informal sources like cooperatives and input sellers was mostly in-kind such as input fertilizers. Therefore, farmers could not value imputed interest rate during borrowing time. The results also showed that the amount of received credit influenced negatively and significantly (at P< 1%) the borrowers' decisions to seek credit from informal sources or to combine both informal or formal sources. That is, when size of desired credit decreased by 1%, farmers' decisions to borrow from informal and combining both sources were affected by 83.2 and 66.3%, respectively. The findings lead to a conclusion that lower-income households, which determine the size of the desired credit borrow, are more likely to borrow from informal sources. The results agree with De Janvry *et al.* (2005) that an increase in household income from non-farm business activities can help to meet the desired investment that results in low dependence on sources of credit.

The results also showed that the coefficient of tea farm size owned by households was at 1% level of significance for both formal and informal sources but with opposite signs. Positive for formal and negative for informal sources, to mean that this factor created a competitive decision to borrow either in formal or informal sources depending on the size of owned tea plantations. Thus, an increased 1 unit of plot size of tea plantation would lead to an increase of 24.8% in using formal sources and a decrease by 39.9% to use informal sources. These findings confirm that borrowing from any source of credit increased if a borrower has had tea plantation. Therefore, the size of a tea plantation is a valuable asset as collateral to get credit.

CONCLUSIONS

This study analyzed factors influencing farmers' decisions to utilize credit sources for the desired credit. Generally, it is practical to borrow from formal sources of credit when an applicant is eligible for the evaluation of lending institutions; otherwise, informal sources are preferred. Determinants of access to credit have been reported in various studies in some contexts. However, existing

[DOR: 20.1001.1.16807073.2021.23.4.9.8]

empirical findings have missed information on how farmers choose a potential source of credit to utilize and inducing factors while the decisions made about the source can further influence the utilization of received credit among competing uses. The current study has tried to make understanding from another side of the credit seekers' decisions when choosing a particular source of credit and the determinant factors. A survey was conducted with 358 tea growers selected randomly in two cooperatives that operated in Nyaruguru District. A multivariate probit model was used to examine factors influencing tea households' decisions to choose a source of credit.

The results showed that those who borrowed from informal sources were less likely to borrow from formal sources. However, they can choose to combine both informal and formal sources of credit as a safeguard strategy and, in particular, when the desired credit is not obtained from a single source. Lack of training on credit management can justify the difference between utilized sources of credit in the area. If farmers prefer to use mostly informal sources and receive a small amount of credit, then this can affect the level of investment in tea sector, consequently, it can affect the desired production of tea and development of tea sector if the government is targeting production through the intensive system. In addition, results showed that a form of no cash credit such as fertilizers are important for tea farmers and mostly are provided by informal sources. In this context, let lending institutions that target small-scale farmers channelize credit via farmers' organizations to meet mutual profit. Again, any intervention for capacitating tea cooperatives is recommended. This can allow tea cooperatives to borrow from any source and an increasing amount of credit on behalf of the members using collective responsibilities as a guarantee. This approach of integrating farmers in financing tea sector will also be a sustainable solution for cases of credit diversion, mismanagement of credit, and bad debts that are known among tea farmers in the area.

ACKNOWLEDGEMENTS

The authors would like to thank the African Economic Research Consortium (AERC) for financial support. The sampled farmers, cooperative leaders, district agronomist are gratefully acknowledged for their cooperation in providing necessary information. Finally, we thank the surveyors for their commitment during the survey.

REFERENCES

1. Adeagbo, S. and Awoyinka, Y. 2009. Analysis of Demand for Informal and Formal Credit among Small Scale Cassava Farmers in Oyo State, Nigeria. *J. Agric., Fores. Social Sci.*, **4(2):** 50–59.
2. Ali, D. A., Deininger, K. and Duponchel, M. 2014. Credit Constraints, Agricultural Productivity, and Rural Nonfarm Participation Evidence from Rwanda. The World Bank.
3. Augustin, S. 2012. *Rural Financial Markets in Rwanda : Determinants of Farmer Households' Credit Rationing in Formal Credit Markets*. A MSc Thesis in International Development Studies Wageningen University, The Netherlands, P.12.
4. Bendig, M., Giesbert, L. and Steiner, S. 2009. Savings, Credit, and Insurance: Household Demand for Formal Financial Services in Rural Ghana. GIGA Working Paper no 76: 1-26, German Institute of Global and Area Studies, Hamburg, Germany.
5. BNR. 2017. *A Resilient Financial Sector and a Rebounding Economic Performance. The Rwandan Banker*, Issue 30, ISSN 2410-684. National Bank of Rwanda, 5. https://www.bnr.rw/fileadmin/AllDepartment/services/Announcement/THE_BANKER_2018_WEB.pdf
6. Boucher, S. R., Guirkinger, C. and Trivelli, C. 2009. Direct Elicitation of Credit Constraints: Conceptual and Practical Issues with an Application to Peruvian Agriculture. *Econ. Dev. Cult. Change*, **57(4)**: 609–640.

[DOR: 20.1001.1.16807073.2021.23.4.9.8]

7. Cappellari, L. and Jenkins, S. P. 2003. Multivariate Probit Regression Using Simulated Maximum Likelihood. *Stata J.*, **3(3):** 278–294.
8. De Janvry, A., Sadoulet, E. and Zhu, N. 2005. The Role of Non-Farm Incomes in Reducing Rural Poverty and Inequality in China. *Research Papers in Economics. No 1001* (Issue March). University of California, Berkeley, 18.
9. Deborah, A., John, J. O., Jacob, G. A., Frank, B. M. and William, E. 2017. Institutional Determinants of Credit Utilization in the Savings and Credit Cooperatives in Soroti District, Uganda. *Afr. J. Rur. Dev. (AFJRD)*, **2(2):** 175–182.
10. Diagne, A. and Zeller, M. 2001. Access to Credit and Its Impact on Welfare in Malawi. Intl. Food Policy Res. Inst., **116.**
11. Gemere, A. W. 2017. Determinants of Formal Sources of Credit Loan Repayment of Small Holder Farmers in Wogera Woreda. *Int. J. Afr. Asian Stud.*, **31:** 7–15.
12. Gobena, G. K. and Jembere, T. 2016. Formal Vis-a-Vis Informal Financial Institutions as a Source of Credit for Micro and Small Enterprises in Ethiopia: Empirical Evidence from Wolaita and Dawro Zones, Ethiopia. *Eur. J. Bus. Manage.*, **8(10):** 8–16.
13. GOR. 2018. Rwanda 2018 Comprehensive Food Security and Vulnerability Analysis (Issue April). http://www.wfp.org/food-security
14. Greene, W. H. 2002. *Econometric Analysis*. Prentice Hall, New York, NY.
15. Houseini, S. S., Khaledi, M., Ghorbani, M. and Brewin, D. G. 2012. An Analysis of Transaction Costs of Obtaining Credits in Rural Iran. *J. Agr. Sci. Tech.*, **14(2):** 243–256.
16. Ijioma, J. C. and Osondu, C. K. 2015. Agricultural Credit Sources and Determinants of Credit Acquisition by Farmers in Idemili Local Government Area of Anambra State. *J. Agric.l Sci. Technol. B*, **5(1):** 34-43.
17. Jema Haji, B. K. T. 2017. Determinants of Honey Producer Market Outlet Choice in Chena District, Southern Ethiopia: A Multivariate Probit Regression Analysis. *Agric.and Food Econ.*, **5(1):** 5–8.
18. Kochar, A. 1997. An empirical Investigation of Rationing Constraints in Rural Credit Markets in India. *J. Dev. Econ.*, **53(2):** 339–371.
19. Kofarmata, Y. I., Applanaidu, S. D. and Hassan, S. 2016. Determinants of Demand for Credit: A Conceptual Review. *AJEER*, **3(1):** 6–10.
20. Legesse, D. 2016. What Factors Affect Households' Decision to Allocate Credit for Livestock Production? Evidence from Ethiopia. MPRA Paper No 69344, 1-29, Addis Ababa.
21. McCulloch, R. and Rossi, P. E. 1994. An Exact Likelihood Analysis of the Multinomial Probit Model. *J. Econom*, **64(1–2):** 207–240.
22. Mgbakor, M. N., Uzendu, P. O. and Ndubisi, D. O. 2014. Sources of Agricultural Credit to Small-Scale Farmers in EZEAGU Local Government Area of Enugu State, Nigeria. *IOSR J. Agri. Vet. Sci. (IOSR-JAVS)*, **7(8):** 1-8.
23. MINECOFIN. (2012). *Rwanda Vision 2020.* Revised in 2012, Kigali, Rwanda.
24. MINECOFIN. (2013). National Microfinance Policy Implementation Strategy 2013-2017 Issue August 2013.
25. MINICOM. 2013. *Rwanda National Export Strategy II.* Ministry of Trade and Industry. Kigali, Rwanda.
26. Moahid, M. and Maharjan, K. L. 2020. Factors Affecting Farmers' Access to Formal and Informal Credit: Evidence from Rural Afghanistan. *Sustainability*, 12(3): 1268.
27. Mpuga, P. 2010. Constraints in Access to and Demand for Rural Credit: Evidence from Uganda. *Afr. Dev. Rev.*, **22(1): 1**15–148.
28. Muhongayire, W. 2012. An Economic Assessment of the Factors Influencing Smallholder Farmers' Access to Formal Credit: A Case Study of Rwamagana District, Rwanda. University of Nairobi.
29. Mwendwa, M. B. 2013. Factors Influencing Access to Formal Credit by Small Scale Women Tea Farmers in Kenya: A Case of Thika District, Kiambu County. University of Nairobi.
30. NAEB. 2013. *Annual Report 2012-2013*. Kigali, Rwanda.
31. NISR. 2012. *Access to Finance*. Handbook of Development Economics, Vol. 2.
32. NISR. 2018. Agricultural Household Survey 2017. National Institute of Statistics of Rwanda.
33. Nwaru, J. C., Essien, U. A. and Onuoha, R. E. 2011. Journal of Rural and Community Development Determinants of Informal Credit Demand and Supply among Food

Crop Farmers in Akwa Ibom State, Nigeria. *JRCD,* **6(1)**: 129–139.
34. Oshaji, I. 2018. Determinants of Credit Sources Utilized By Small Scale Arable Crop Farmers In Imo State, Nigeria. *Adv. Soc. Sci. Res. J.*, **5(6).**
35. Owuor, G. and Shem, A. O. 2012. Informal Credit and Factor Productivity in Africa: Does Informal Credit Matter? Paper Presented at the International Association of Agricultural Economists (IAAE) Triennial Conference, August 18-24, 2012, Foz do Iguacu, Brazil. http://ageconsearch.umn.edu/bitstream/126624/2/Owuor.pdf.
36. Papias, M. M. and Ganesan, P. 2010. Financial Services Consumption Constraints: Empirical Evidence from Rwandan Rural Households. *J. Financ. Serv. Market.*, **15(2):** 136–159.
37. Pham, T. T. T. and Lensink, R. 2007. Lending Policies of Informal, Formal and Semiformal Lenders. *Econ. Transit.*, **15(2):** 181–209.
38. Pishbahar, E., Ghahremanzadeh, M., Ainollahi, M. and Ferdowsi, R. 2015. Factors Influencing Agricultural Credits Repayment Performance among Farmers in East Azarbaijan Province of Iran. *J. Agr. Sci. Tech.*, **17(5):** 1095–1101.
39. Poirier, D. J. and Kapadia, D. 2012. Multivariate Versus Multinomial Probit: When are Binary Decisions Made Separately also Jointly Optimal? *In Cities, Open Economies, and Public Policy*, PP. 1–12).
40. Salami, A. and Arawomo, D. F. 2013. Empirical Analysis of Agricultural Credit in Africa: Any Role for Institutional Factors. *Afr. Dev. Bank Group*, **192:** 1-28.
41. Stiglitz, J. and Hoff, K. 1990. Introduction: Imperfect information and rural credit markets: Puzzles and policy perspectives. *World Bank Econ. Rev.*, **4(3):** 235–250.
42. Tarekegn, K., Haji, J., and Tegegne, B. 2017. Determinants of Honey Producer Market Outlet Choice in Chena District, Southern Ethiopia: a Multivariate Probit Regression Analysis. A*gric. Food Econ.*, **5(1):** 1–14.
43. World Bank. 2013. Impact Evaluation of Tea Sector Reforms in Rwanda Methodology Note. Kigali, Rwanda.
44. World Bank. 2019. *Rwanda Economic Update: Lighting Rwanda.* The World Bank Group, Kigali, Rwanda
45. Yamane, T. (1967). Statistics, An Introductory Analysis, 1967. *New York Harper and Row CO. USA*, *213*, 25.

عوامل موثر بر تصمیم چایکاران برای استفاده از منابع اعتباری در منطقه Nyaruguru در رواندا: تحلیل رگرسیون Probit چند متغیره

ا. کابایزا، گ. اوور، ج. ک. لانگت، و ف. نیتانگا

چکیده

وام وسیله ای عمده و عامل مهمی در تولید چای و درآمد زارعین است و تقاضا برای آن از منابع وام دهنده به منظور سرمایه گذاری در بخش تولید چای رو به افزایش می باشد. این وام برای تامین هزینه های تولید چای به ویژه برای کود شیمیایی، قلمه چای، و هزینه کارگری است. از این رو، عوامل موثر در دستیابی به این وام موضوع بحث های زیادی در پژوهش های سالهای اخیر بوده است که متقاضیان وام فقط زمانی وام دریافت می کنند که حایز شرایط اعلام شده توسط منابع وام دهنده باشند. با این همه، درمنابع علمی یافته های محدودی در باره رفتار وام گیرندگان کوچک-مقیاس در انتخاب منبع وام

[DOR: 20.1001.1.16807073.2021.23.4.9.8]

وعوامل القایی (inducing factors) وجود دارد. به طور مشخص، اقدامات مربوط به گرفتن وام به گونه ای است که برای آگاه کردن سیاستگزاران از تنظیمات مورد نیاز در سامانه وام دهی با هدف بهبود تولید چای وتوسعه این بخش، انجام تجزیه تحلیل ضروری می شود. هدف پژوهش حاضر شناسایی عوامل مسول و موثر در چایکاران کوچک-مقیاس برای انتخاب یک منبع وام دهنده است. به این منظور، یک نظر سنجی انجام شد که در آن 358 چایکار به طور تصادفی از دو تعاونی فعال در منطقه Nyaruguru شرکت داشتند. برای تجزیه تحلیل داده ها از یک مدل پروبیت (probit) چند متغییره استفاده شد. نتایج نشان داد که وام گرفتن از یک منبع رسمی(formal) (بانک های تجاری) زمانی افزایش می یافت که متقاضی وام دارای دارایی وثیقه (collateral asset) بود(85/5٪)، مقدار آن به نرخ بهره (85٪)، اندازه باغ چای(24/8 ٪) و ترکیب جمعیتی خانوار(10/5 ٪) بستگی داشت. استفاده از منابع غیر رسمی در شرایطی زیاد می شد که کشاورزان وام کوچکی درخواست داشتند (83/2 ٪)، یا در دوره های آموزشی شرکت کرده بودند (76/9 ٪)، و وام دستجمعی (46/9 ٪) میخواستند. در مواردی که مساحت باغ چای یا درآمد خانوار کوچک بود، احتمال این بود که کشاورزان کمتر(به ترتیب 39/9٪ و29/2٪) از منابع غیر رسمی وام استفاده می کردند. با این وجود، کشاورزان از استراتژی حفاظتی کاربرد ترکیبی از منابع وام دهنده برای دستیابی به وام مورد نظرشان بهره می جستند. چنانچه هدف سیاست دولت افزایش سرمایه گزاری تولیدی باشد، لازم می شود که یکپارچه کردن وام های کشاورزی در سامانه مالی هدفمند برای کشاورزان خرده پا از طریق نهادهای مربوط به آنان مورد تاکید باشد تا بتوانند محدودیت های وام گیری را تسهیل نمایند.

[DOR: 20.1001.1.16807073.2021.23.4.9.8]