Determinants and Effect Evaluation of Credits on the Farm Outcome - A Micro-Perspective of Tea Production from Rwanda

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Abstract

Credit is a crucial factor for tea growers to pay for physical farm inputs mainly fertilizers, high yielding tea clones and hired tea pluckers labour in order to improve the production of green tea leaf and to meet factories demand for raw materials. Along with made interventions to increase funds, mismanagement of accessed credit by farmers has been reported among the issues for the sector development that remains suboptimal. The study analyzed the determinants and impact of tea credits utilized among tea-farming households in Nyaruguru District, Rwanda. Cross-sectional tea household level data were collected from 358 farmers randomly selected from tea cooperatives. The credit utilization and causal effect was estimated using endogenous switching regression model. Results revealed positive and significant causal effect of credit is 7% increase in tea income for who utilised credit for tea production while its potential effect is up to 55% decrease in tea income for those who actually divert credit for out-off tea production uses. Furthermore, training on agricultural practices and credit management, cost of farm inputs and labour and access to group credit influence utilizing of credit for tea production. However, size of credit (cash) and off-farm businesses increase diversion of credit and level of tea farm income. Farmers are encouraged to use tea credits for planned projects. Sensitizing farmers to procure farm input fertilizers in bulk through cooperatives should be vigorously pursued to discourage credit diversion.

Key words: Credit utilization, tea farmers, green tea leaf, farm income, endogenous switching regression

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Introduction

Agriculture investment is a national priority for transforming agriculture and greater financial inclusion. The yielded substantial progress in financing agriculture results from government' s funding measures for access to financial services for farmers and agribusinesses through the Financial Sector Development Program (2013-2018), The national Financial Inclusion Strategy (NFIS) and the National Agriculture Policy (NAP) (GoR, 2012). Rwanda additionally so has two key market development entities-the Development Bank of Rwanda (BRD) and the Business Development Fund (BDF) which are dynamic in agriculture investment. Through the National Bank of Rwanda (NBR) there is a system of monitoring credit disbursed to the agriculture by value chains and value chain stages in all financial institutions-commercial banks, Microfinances (MFIs) and SACCOs. Furthermore, Access to Finance, Rwanda is a specialized donor-funded initiative and for World Bank's lending projects that focusing on Agri-finance support and interventions. As result, the loans for agriculture increased from 57billion in 2012 to 90billion in 2016 (World Bank, 2018). The Agri-processing and tea production were leading the investment over this period.

Tea production was among the country priorities for reforms implemented in the agriculture transformation since 2013 because of its economic role for the country (World Bank, 2013). Tea production plays an important role in productivity of tea factories, job creation for rural communities by increasing farmers' daily income and finally, its exports' share remains significant in foreign exchange balance for some countries like Rwanda(FAO, 2020). Furthermore, tea sector in Rwanda offers additional advantages. In particular, tea cultivation helps to enhance productivity of acidic soils, fighting erosion and runoff in South-Western regions. Economically, the government of Rwanda views tea sector in the loop of increasing tea export volumes reaching 3% of the global market by 2024(NAEB, 2019).

Government policies for tea sector improvement started back from 1999 with a reform program that aimed to privatize the government owned tea factories and plantations to stimulate investment in the sector while attracting foreign investment (Essama-Nssah *et al.,* 2008). The privatization was accompanied by the introduction of new green leaf pricing scheme for pluckers to provide incentive for higher quality and productivity, and expansion of tea factories in 2006 (MINAGRI, 2012); tea expansion program 2012-2017 to plant new 18,000 ha of tea plantations of which 10,000ha of new sites and construction of 5 new factories in South-West regions of the country to boost quality and productivity (RoR, 2013) and the increase and facilitation of access to inputs by farmers, capacity building and more R&D efforts to have improved tea seedlings for farmers (NAEB, 2019). The above interventions have made high demand for tea credit, its utilization remains necessary for intensive production and sector growth (Abedullah *at al*., 2009; Bekun *et al.*, 2018).

Though, the production of tea factories in Rwanda is still challenged by small scale tea production system by independent farmers who own 70% of total tea plantations, the situation is coupled with the rate of effective utilization of agricultural credit by farmers which remains suboptimal (World Bank, 2018). This observed critical cases are when farmers fully or partially divert credit from initial purpose to off-farm uses that affects the optimal production of green tea leaf and farmers' income (Bashiru *at al*., 2014; Reza *at al.*, 2017; Vedamurthy, 2014).

Available studies have been limited determinants of financing the sector and the barriers to reach the optimum tea farm investment such as limited factors to borrow from formal sources for desired size to raise tea investment by small scale farmers (Musabanganji *et al.*, 2015) and farmers' participation in formal credit markets in rural areas of Rwanda (Muhongayire *et al.*, 2013) and availability and affordable financial services in rural and remote areas (Malimba and

Ganesan, 2010; Fuglie *et al.*, 2013). However, analytical tool for decoupling credit utilization on farm and non-farm investment is missing to give as a comprehensive credit effect on farm income. There is also need of study that accounting the endogeneity effect to come up with consistent findings.

This study analysis the effect of credit utilization on tea income among tea farmers in Nyaruguru District, Rwanda. Additionally, the study assesses whether credit utilization is a viable strategy in increasing green tea leaf production in the area.

Theoretical and analytical framework

The provision of framework is for measuring the effect of utilizing credit and differences between non-diverted credit and diverted credit farmers of accessed credit for tea production purpose by controlling endogeneity effect. The credit utilization modelling is here referred to the Random Utility Theory (RUT), which assumes that a farmer is a risk neutral and any made decision of utilizing credit will definitely influence the utility derived from utilization. The same theory allows us to assume that a farmer chooses to invest credit between tea farm and non-tea farm businesses based on the risked utility to be received. The examination is worked around the *anticipated* income from supplied green tea leaves as a function of credit utilized for tea production. Note that this function does not specify tea farm income as total working capital (Feder *et al.,* 1990).

The issue of endogeneity in utilizing credit results from the fact that utilization is voluntary (self-selection). Farmers choose to utilize credit for tea enterprise by taking into account (among other factors) the benefit they can derive from it, representing here by the gross income paid for supplied green tea leaves to the factories. The reliability of econometric efforts to estimate the attribution of credit on farm income eventually relies upon the capacity to measure and control for *all* systematic differences between non-diverted credit and diverted credit farmers. One reason for questioning the adequacy of these efforts is the likely positive relation between credit use and unmeasurable factors. Beyond observables factors, unobservable variables such as skill levels, agricultural practices, technical know-how and soil quality, entrepreneurial ability, could also affect farm productivity and income.

In investigating the effect of utilizing credit on tea farm productivity and farm income, it would be simplistic and biased to just attribute the differences in tea farm outcomes between two groups of farmers. In experimental data, there would not be a problem of causal inference because the counterfactual situation is known (Miguel & Kremer, 2004). However, in the case of cross-sectional survey data the counterfactual is not known which creates an issue to interpreting causal inference in such situation. Misreading the situation by not controlling unobservable factors can led to overestimate, underestimate or report the impact where none exists at all. These include types of social networks that are not captured such as the kind of neighbours the farmer speaks to and whether such neighbours had used credit. Second, transaction costs that can be incurred by farmers because of poor access to inputs suppliers. Last but not least, innate managerial and technical abilities of optimally utilizing available resources among others. This can justify the use of econometric models.

The choice of econometric model for investigating the implication of utilising credit on tea farm income is based on its capacity to account for potential endogeneity resulting from structural differences between characteristics of household farmers and technical efficiency they have adopted in their respective categories(Di Falco *et al.*, 2011).

The endogenous switching regression (ESR) approach which was developed by Lee (1982) and Green (2002) is a generalized of Heckman's selection correction approach. It treats selectivity as an omitted variable problem (Heckman, 1979). Since the income from tea production is observed for non-diverted credit and diverted credit farmers, switching regression approach separates farmers in two regimes based on how they had utilised credit in order to capture the differential responses of the two groups. The ESR model addresses such endogeneity error by regressing simultaneously credit utilization or selection equation and the farm income equations of estimators in the model (Hausman, 1983; Feder *et al.,* 1990; Freeman *et al.,* 1998 & Greene, 2002) using full information maximum likelihood approach suggested by Lokshin & Sajaia (2004). The approach built in the model is able to disentangle the effect of credit from that generated by the difference in the observable and latent attributes of non-diverted credit and diverted credit farmers (Green, 2002; Lokshin & Sajaia, 2004). The model takes into account self-selection to measure the effect of utilizing credit on tea income.

Materials and Methods

Data collection

The study used primary data collected through farmers' survey. A population is all tea household farmers. A stratified sampling technique to select household tea farmers in Nyaruguru district. The selected two cooperatives; COTHENK with 2,560 farmers and COOTHEMUKI with 885 farmers are the only two cooperatives that operating along Nyungwe natural forest and national park from South-West to the North-West in the district. The following are used formula to calculate the total simple from the population and from stratum respectively.

$$n = \frac{N}{1+N(e)^2}$$

and, …………..…………………………………………………………….(1)

$$n_i = \mathrm{n}\frac{N_i}{N}$$

with,

$\boldsymbol{n}$ = Estimated total sample size.

$\boldsymbol{N}$ = Total population size.

$\boldsymbol{N_i}$=Total population size in the stratum.

$\boldsymbol{n_i}$ = Estimated sample size in the stratum.

$\boldsymbol{e}$ = Represents the level of precision.

From a population of 3,445 farmers, a total of 358 farmers is the sample size for the survey interview of which 266 and 92 farmers randomly selected from the two cooperatives respectively.

Tea farmers in each cooperative were further classified into two groups based on their credit utilization performance from records of their respective cooperatives. The performance was evaluated as the rate in percentage at which a received credit was utilized for exclusively tea production. i.e., reported credit diversion or non-diversion cases. Stratified technique was to ensure the representation of targeted respondents in the specific strata.

Data collection activity used three methods; questionnaires to collect quantitative data from tea farmers, cooperatives' records and reports and key informants for additional information. During survey, semi-structured questionnaires were used to randomly selected tea farmers. The survey was conducted through face-to-face to interviewing tea household representatives. Thereafter, Endogenous Switching regression model was used to have empirical estimates.

Endogenous Switching Regression (ESR) model specification

The credit utilization for intended project for a farmer is driven by projected gross margin under assumptions. Modelling the situation assumes that the utility (tea farm outcomes) a farmer i derives by allocating fully accessed credit for tea production or non-diverted credit is y_{NDC} and the utility when diverting credit for out of tea production or diverted credit is symbolized as y_{DC}.

The two groups of farmers can be expressed as;

$$y_{iNDC} = x_i\beta_{NDC} + \varepsilon_{iNDC} \text{ and, } \quad y_{iDC} = x_i\beta_{DC} + \varepsilon_{iDC} \qquad \text{..........} (2)$$

where, x_i is a vector of explanatory variables. β_{NDC} and β_{DC} are parameter estimates for non-diverted and diverted credit categories respectively. ε_{iNDC} and ε_{iDC} are independent and identically distributed error terms. Under random utility assumption, if utilizing credit for tea enterprise a farmer expects to derive the higher gross margin, this case be expressed as $y_{iNDC} >$

y_{iDC}. However, some determinants that influence the farmer's decision are unknown to the researcher. To account selection and switching between two regimes, the endogenous switching regression model addresses the issue in two stages. The first is selection model for utilizing received credit for tea production or for alternative and competing uses. That is D_i^*, a latent variable determines which regime the tea household farmer faces:

$$D_i^* = \gamma_i z_i + u_i \ ; D_i = 1 \ if \ D_i^* > 0; \ D_i = 0 \ if \ D_i^* \leq 0 \qquad \text{.................................} (3)$$

where D_i is binary variable that take 1 value for non-diverted credit regime and zero value for diverted credit regime. γ_i is a vector of parameters to be estimated as the marginal effect of being in one of the two regimes. The error term u_i with mean zero and variance σ_ε^2 for measuring errors. Variables z_i as independent instrument that includes unmeasured confounding factors and attributes that influence decision of utilizing of credit for tea enterprise or not.

The second stage is the tea farm outcome (i.e., quantity of green tea leaves produced) or farm income equation that split endogenous model into two regimes(Maddala, 1983; Lokshin & Sajaia, 2004). Following the arguments in the equation (3), description of the two regimes, farmers' category takes the following values:

Regime 1: Non-Diverted Credits (NDC): $y_{1i} = \beta_1 x_{1i} + \varepsilon_{1i}$ if $D_i = 1$

Regime 2: Diverted Credits (DC): $y_{2i} = \beta_2 x_{2i} + \varepsilon_{2i}$ if $D_i = 0$ ………. (4)

Where y_{iNDC} and y_{iDC} are gross margins from non-diverted and diverted credit farmer's regimes respectively. x_{1i} and x_{2i} vectors of independent variables. β_1, β_2 and γ are parameters to be estimated. ε_{1i} and ε_{2i} are error terms for non-diverted and diverted credit farmers respectively. D_i is dummy variable to distinguish two regimes. It measures endogenous to farm income y_i and to other exogenous variables x_i, which must be captured in the ESR model.

The self-selection caused by the correlation of the error terms of the decision and the gross margin equations. Maddala (1983) explained that error term u_i is linked to the error terms $(\varepsilon_{1i}, \varepsilon_{2i})$ in Eq.4. The three errors are correlated and have a positive value i.e., corr (u_i, $\varepsilon_{1i}, \varepsilon_{2i}) \neq 0$. In the other words, the error terms u_i, ε_{1i} and ε_{2i} have trivariate normal distribution, with mean vector zero and covariance matrix expressed as:

$$cov\ (u_i, \varepsilon_{1i}, \varepsilon_{2i}) \begin{bmatrix} \sigma_u^2 & \sigma_{u1} & \sigma_{u2} \\ \sigma_{1u} & \sigma_1^2 & \sigma_{12} \\ \sigma_{2u} & \sigma_{21} & \sigma_2^2 \end{bmatrix} \dots\dots (5)$$

Where the variance of the error terms in the selection equation and the two gross margin regimes 1 and 2 is denoted by σ_u^2, σ_1^2 and σ_2^2 respectively. Mathematically, this variance can be expressed as; $\sigma_u^2 = var(u_i)$; $\sigma_1^2 = var(\varepsilon_{1i})$ and $\sigma_2^2 = var(\varepsilon_{2i})$.

The covariance of the error terms from the selection equation u_i and the gross margin regimes $1(\varepsilon_{1i})$ and $2(\varepsilon_{2i})$ is respectively denoted by σ_{u1} and σ_{u2}. Mathematically, the respective covariance between error terms is expressed as; $\sigma_{u1} = var\ (u_i, \varepsilon_1)$ and $\sigma_{u2} = var(u_i, \varepsilon_2)$. However, as two outcome equations for two regimes i.e., y_{1i} and y_{2i} variables can never be observed simultaneously for a single tea farmer, the σ_{12} or σ_{21} in the covariance matrix is therefore not present (Maddala, 1983).

From the aforementioned equation (4), the values of the error terms for the two regimes $(\varepsilon_{1i}|D = 1)$and $(\varepsilon_{2i}|D = 0)$ are different from zero. They estimated using probit in the first stage of endogenous switching regression model (ESR) to produce Inverse Mill Ratios (IMR); λ_{1i} and λ_{2i} estimates (Greene, 2002) derived according to definitions in Eq.4 as follows:

$$E(\varepsilon_{1i}|D_i = 1) = E(\varepsilon_{1i}|u_i > -\gamma_i z_i) = \sigma_{1u}\left[\frac{\phi(\gamma_i z_i)}{\Phi(\gamma_i z_i)}\right] \equiv \sigma_{1u}\lambda_{1i}$$

$$\dots\dots(6)$$

$$E(\varepsilon_{2i}|D_i = 0) = E(\varepsilon_{2i}|u_i \leq -\gamma_i z_i) = \sigma_{2u}\left[\frac{-\phi(\gamma_i z_i)}{1 - \Phi(\gamma_i z_i)}\right] \equiv \sigma_{2u}\lambda_{2i}$$

Where ϕ and Φ are the standard normal probability and cumulative distribution functions respectively. The ratio of ϕ and Φ evaluated at $\gamma_i z_i$ (Eq.6) is referred to as the Inverse Mills Ratio λ_{1i} and λ_{2i}(selectivity terms).

In the second stage of endogenous switching regression, the predicted variables in the Eq.6 are then added to the appropriate equation in Eq.4 to yield

$$y_{1i} = \beta_1 x_{1i} + \sigma_{1u}\lambda_{1i} + u_{1i} \quad \text{if } D_i = 1 \text{ and,}$$
$$y_{2i} = \beta_2 x_{2i} + \sigma_{2u}\lambda_{2i} + u_{2i} \quad \text{if } D_i = 0 \qquad \text{……………………………(7)}$$

Where u_{1i} and u_{2i} have zero conditional mean. The coefficients of the variables λ_{1i} and λ_{2i} provide estimates of the covariance terms σ_{1u} and σ_{2u} respectively. The difference of Inverse Mills Ratios between two regimes is a based on comparative advantage and would expect to be positive. i.e., $\sigma_{1u} - \sigma_{2u}$>0 to indicate that utilizing credit for tea production would result higher yield and gross margin than investing out of tea enterprise.

Since the interest is the evaluation of the effect of utilizing credit on tea farm outcome (green tea leaves produced or gross margin), there is a need of assessing the treatment and heterogeneity effect on tea farm outcome. Lokshin & Sajaia (2004) suggested that full information maximum likelihood (FIML) is enough for regressing simultaneous equations for two regimes. The approach estimates both the selection and tea farm income equations to obtain standard errors. The ***movestay*** command in the STATA 16 is sufficient to run the endogenous switching regression model.

The signs and significance of correlation coefficients ($\sigma_{1u} and\ \sigma_{2u}$) of the error terms from estimated two regimes' equations (treatment and outcome equations. i.e., Eq.7) have meaningful interpretations (Maddala, 1983; Awotide *et al.,* 2015). If either σ_{1u} or σ_{2u} is significantly different from zero there is endogenous switching which would result from the selection bias. If $\sigma > 0$ a negative selection, bias is present. The interpretation of this would mean that tea farmers with below average gross margins are more likely to utilize credit for tea production. On other hand, if $\sigma < 0$ a positive selection bias is present meaning that tea farmers with above average gross margins are more likely to utilize credit for tea production investment. Similarly, Fuglie & Rada (2013) argued that if both σ_{1u} or σ_{2u} coefficients have alternative signs, the credit utilisation choice is done based on comparative advantage; farmers who utilize credit for tea production earn above-average returns from utilization and those who diverted credit earn above-average returns from alternative uses. On the other hand, if the coefficients have the same sign, farmers who utilise credit earn above-average returns whether they utilize credit for tea production or not, but they are better off utilizing credit for tea farms, whereas those who diverted credit have below-average returns in either case, but they are better off using credit for alternative uses out off-tea production.

Estimating treatment and heterogeneity effects on tea production and gross margin

The estimation of the average treatment effect on the treated (ATT) and untreated (ATU) is estimated using the aforementioned endogenous regression model results by comparing two groups. The observed values of tea farm income for non-diverted credits and diverted credits farmers' groups are computed as follows:

Non-Diverted Credits (NDC) observed in the sample: $[y_{1i}|D = 1] = \beta_1 x_{1i} + \sigma_{1u}\lambda_{1i}$ … (8)

Diverted Credits (DC) observed in the sample: $[y_{2i}|D = 0] = \beta_2 x_{2i} + \sigma_{2u}\lambda_{2i}$ … (9)

where $D = 1$ for non-diversion case and $D = 0$ for diversion case. $y_{1i}$and y_{2i} are tea farm income for non-diverted and diverted farmers' regimes respectively. In the same style, the counterfactual expected tea farm income for two groups is:

Non-diverted credit counterfactual $[y_{2i}|D = 1] = \beta_2 x_{1i} + \sigma_{2u}\lambda_{1i}$ ……………………(10)

Diverted credit counterfactual $[y_{1i}|D = 0] = \beta_1 x_{2i} + \sigma_{1u}\lambda_{2i}$ ………………… (11)

The average treated effect (ATT) of credit utilization on tea farm income for non-diverted credit group is computed as the difference between equations (8) and (10) as follows:

$ATT = E[Y_{1i}|D = 1] - [y_{2i}|D = 1] = x_{1i}(\beta_1 - \beta_2)$+ ($\sigma_{1u} - \sigma_{2u})\lambda_{1i}$ …………..……...(12)

and the average treated effect (ATU) of credit utilization on tea farm outcomes for diverted credit group (untreated) is computed as the difference between equations (11) and (9) as follows is:

$ATU = E[Y_{1i}|D = 0] - [y_{2i}|D = 0] = x_{2i}(\beta_1 - \beta_2)$+ ($\sigma_{1u} - \sigma_{2u})\lambda_{2i}$……………..…… (13)

The base heterogeneity (BH) effects that refer to the differences in the tea farm outcomes due to the inherent differences beside of tea production such as having other businesses and not that of the treatment can be computed. The heterogeneity effect for non-diverted credit group is computed as the difference between equations (8) and (11),

$[y_{1i}|D = 1] - [y_{1i}|D = 0] = \beta_1(x_{1i} - x_{2i}) + \sigma_{1u}(\lambda_{1i} - \lambda_{2i})$

And that of the diverted credit group as the difference between equations (10) and (9),

$[y_{2i}|D = 1]$-$[y_{2i}|D = 0] = \beta_2(x_{1i} - x_{2i}) + \sigma_{2u}(\lambda_{1i} - \lambda_{2i})$

Finally, transitional heterogeneity (TH) is estimated as if the effect of utilising credit is larger or smaller for the farmers that actually utilized credit for tea production or for the farmers that actually diverted credit in the counterfactual case. That is the difference between equations (12) and (13); i.e., (ATT) and (ATU).

Results and discussions

Characteristics and descriptive statistics of the respondents

The age of the respondent is positive and significant at 5 percent level (Table2). This implies that farmer's age is positively correlate with credit utilisation decision. This also shows that older farmers are uprightness in utilising credit for tea production than youth as they are risk averse to venture for income diversification (Langyintuo & Mekuria, 2005).

In the results (Table2), the mean difference of size of tea plantation owned was found to be no significant between the two groups of household farmers. This is possible because tea plantation is a long-term cycle plant and its production can be improved by using input fertilisers and technical efficiency (Nguyen-Van & To-The, 2016). The mean difference of labour cost is significant at 5 level indicating that credit users for tea production invest Frw 65,507 per hectare more than that of diverting credit. Similarly, input fertiliser with a significant mean difference (at 1 percent) of Frw 52,495 per hectare indicating that non-diverted credit for tea production invest more than their counterpart who diverted credit.

The size of credit accessed is also significant at one percent level indicating that farmers who divert credit to off-farm investment have averagely accessed Frw 249,067 more amount than uprightness group that utilise credit for intended tea projects. The explanation is that having off-farm income can reduce the perception of risk for lending institutions especially when borrowers can show different repayment options (Awotide *et al.*, 2015).

Income from tea production was found to have an aggregated mean of Frw 881,827 per hectare per quarter. However, farmers who divert credit to off-tea farm investment earn income (significant at 5 percent) less than (Frw 416,045) that of utilising credit for tea production. The result is empirically argued that higher farm income improves technical efficiency and capacity to jumpstart the agricultural innovation(Amsalu & De Graaff, 2007). Other farmers' characteristics such as the level of education and gender of household head, the size of household and experience in tea farming; they are no significant for both two farmers' categories.

Table 2: Tea household farmers' characteristics for continuous variables (*t*-Statistic)

	Mean difference of tea household characteristics by farmer's regime			
Continuous variables	NDC (n=209)	DC(n=149) Mean	Mean difference	*t*-Statistic

	Mean			
Age of HH (years)	53.23(0.84)	50.52	2.71	-2.1440**
Education of HH (years)	5.23(0.30)	5.32 (0.35)	0.09(0.46)	0.1869
Size of HH (no. of dependents)	6(0.14)	6(0.15)	0.20(0.20)	0.9566
Experience of HH in tea farming (years)	7.23	7.40	0.17	0.7164
Size of tea plantation (Ha)	0.99(0.06)	0.89(0.07)	0.10(0.09)	-1.1422
Tea labour cost (Frw/ha/quarter)	177,978.4 (21,490.76)	112,470.7 (16,839.21)	65,507 (29,159.6)	-2.2465**
Tea input cost (Frw/ha/quarter)	140,162.8 (13,770.72)	87,668.08 (9,958.21)	52,494.69 (18,352.84)	-2.8603***
Size of credit accessed (Frw)	370,411 (37,546)	619,478 (68,009)	-249,067 (72,613)	3.4300***
Tea farm income (Frw/ha/quarter)	881,827 (131,772)	465,782 (83,791)	416,045 (171,392)	2.4274**

****1% level of significance;* ***5% level of significance;* **10% level of significance*

The females constitute minority in both farmers' regimes (Table3). Males represent 83.7% and 81.2% of non-diverted and diverted farmers' categories respectively while females represent 16.2% and 18.8% respectively. However, the chi square test shows no association between gender of the household head and credit utilisation decision.

The results show also that among farmers who accessed credit in groups, around 60.3% have utilised credit for tea production while 44.3% of them have diverted credit. The chi square test is significant indicating that disbursement of credit in groups has a positive association with farmers' decision when utilising credit. The results was supported that borrowing in group itself increases bargaining power for members upon presenting collective responsibility while reducing the perception of repayment risk (Shiferaw *et al.,* 2014). Specifically, farmers who accessed to credit of input fertilisers that are channelized through farmers' cooperatives are likely utilizing them for intended projects because of close supervision of the group leaders compared to their counterparts who individually accessed to the credit.

The result for borrowing status revealed that household farmers were not constrained at 80.7%; which means that they had received desired credit amount. Out of them, 75.1% have utilised accessed credit for intended tea projects while 88.6 % have diverted credit to off-farm uses. The chi square test is positively significant indicating that there is an association between accessed amount and credit utilization decision of farmers.

Table 3: Tea household farmers' characteristics for discrete dummy variables (*Chi*^{2}*test*)

Dummy variables	Sample	NDC (n=209) %	DC(n=149) %	χ^2
Gender (Male=1)	82.68	83.73	81.21	0.3870
(Female=0)	17.32	16.27	18.79	
Credit groups (Yes=1)	53.63	60.29	44.30	8.9454***
Credit non-constrained (Yes=1)	80.73	75.12	88.59	10.1454***
Training on tea GAP (Yes=1)	87.71	93.30	79.87	14.5664***
Training on credit management (Yes=1)	24.02	26.79	20.8	2.1140
Off-tea farm income activities (Yes=1)	45.81	28.71	71.50	59.1634***

****1% level of significance; **5% level of significance; *10% level of significance*

The adoption of agricultural practices (GAP) is significant indicating its influence on how farmers utilizing credit for tea production. Around 93.3% and 89.9% of non-diverted and diverted farmers' categories have respectively participated in organised training on good agricultural practices (GAP). Training on credit use and credit management offered by formal lending institutions to tea farmers was not significant to influence the decision of farmers for credit utilization. The results also show that there is a positive and significant association between running off-tea farm businesses and farmers' decision for credit utilisation. Statistically, only 28.7% of farmers that having off-tea businesses have utilised credit to objectively intended tea projects while 71.5% have preferred to invest accessed credit out of tea enterprise. The positive association between credit diversion from intended project to off-farm businesses have been empirically highlighted in various contexts. Ugbem Oboh & Douglas Ekpebu (2011) and Hussan (2013) argued that farmers divert credit to either diversify income or risk mitigation. As management, training on loan management and regular visit of bank supervisors to credit beneficiaries were highly recommended for some cases in Nigeria and Pakistan.

Determinants of credit utilization on the tea farm income and factors influencing gross margins

The results of endogenous switching regression using full information maximum likelihood are presented in the table4. The first column presents the estimated coefficients of the selection equation on utilization of credit for tea production or diverted to out of tea farm uses. The next two columns (second and third) present the estimated coefficients of the outcome equations of tea farm income for the two regimes of farmers as non-diverted and diverted credit groups or if you want credit non-diverted credit and diverted credit farmers for tea projects respectively.

Factors influencing tea farm income

Turning to the results, the estimates of the first stage of Endogenous Switching Regression (ESR) model presented in Table 4. The variables used in the estimation are various farm and household characteristics and institutional variables that are associated with credit utilization. The dependent variable is logarithm of income from owned tea plantations calculated as the price per kilogram paid by a factory multiplied by the total quantity (in kilogram) of supplied green tea leaves.

The Wald χ^2 test statistic is highly significant indicating the goodness of fit of our ESR model (*p-value=0.000)*. The likelihood ratio test (14.35) of independence of selection and tea farm outcome equations is statistically significant at 1 percent (*p<0.000*) suggesting that the ESR model variables are jointly validated as strong predictors for credit utilisation. An interesting finding is the signs and significance of the covariance terms (ρ_U and ρ_{NU}). The correlation coefficient $\boldsymbol{\rho_{U\varepsilon}}$ indicates the correlation between credit utilization situation and its effect on tea farm outcomes by tea credit users. While the correlation coefficient $\boldsymbol{\rho_{NU\varepsilon}}$ indicates the correlation between credit utilization situation and its effect on tea farm outcomes by tea credit non-users.

The results show that the covariance terms for both regimes are all statistically significant, indicating that the self-selection occurred in credit utilization decision. Thus, utilizing credit for tea production may not have the same effect on those who divert credit, if they choose to utilise for tea projects as well. Moreover, having the same signs, positive and statistically significant for both farmers' categories implies that utilizing credit has significant positive effect on farm outcomes (yields and net returns), thus credit user farmers obtained higher yields and net returns than a random individual from the sample would obtain. This is also confirmed since the necessary conditions for consistency are fulfilled ($\rho_U > \rho_{NU}$) indicating that credit users for tea production obtain higher outcome that they would if they deviate credit to off tea uses.

The ESR estimates show that the positive and significant variables of gross margins for non-diverted credit farmers are; age, size of tea plantation, experience in tea farming, training on good agricultural practices, visits of lending institutions officers for monitoring, the cost of hired labour and input fertilisers. For diverted credit farmers' group, significant variables include; size of tea plantation, experience in tea farming, training on tea good agricultural practices, training on credit use and management, cost of hired labour and input fertilisers as well.

Age has positive impact on tea farm income for tea credit users. Association of age with tea income implies that older people may be more risk-averse and reluctant to start off-farm ventures than younger people who are risk takers. Therefore, there is low rate of tea credit diversion to off-tea production projects for elder people. The finding are in line with findings of Adego (2019).

The investment for tea production is used as a proxy of credit utilization by obtaining inputs, hiring labour and all related inputs to produce green tea leaf. The results show that the size of the owned tea plantation is significantly associated with tea farm income for both farmers' regimes *citeris paribus*. A 1% increase in credit to purchase one hectare for increasing tea plantation leads to increase in income for non-diverted credit and diverted credit farmers at 45.4% and 32.8% respectively other factors held constant. This means that the volume of fresh tea leaves produced may be primarily dependent on the size of the tea plantations owned by a farmer. The results are in line with other findings that farm size is simultaneously an input factor and determinant of technical efficiency(Alvarez & Arias, 2003). Similarly, Kanburi Bidzakin *et al.,* (2019) showed this association between the size of arable land and farm productivity.

Table 4: Endogenous switching regression results for credit utilization and tea farm output equations (in ln of income)

		Gross margins	
Variables	Selection	NDC	DC
Constant	7.374 (1.110)	10.223(0.574)	9.485(0.625)
Gender	-0.045(0.208)	-0.024(0.204)	0.113(0.221)
Age	0.009(0.007)	0.013*(0.008)	0.009(0.007)
Education	0.018(0.020)	-0.028(0.020)	0.013(0.020)
Tea plantation size	0.112(0.103)	0.454***(0.106)	0.328***(0.109)
Experience in tea farming	-0.040(0.040)	0.084**(0.038)	0.071*(0.040)

Credit non_constrained	-0.240(0.221)	-0.265(0.263)	0.150(0.196)
Training on GAP[3]	0.965***(0.254)	0.483**(0.220)	0.822**(0.350)
Training on credit Mgt	0.758***(0.221)	0.327(0.221)	0.466**(0.198)
Lending fin. visits	-0.145(0.175)	0.384**(0.176)	0.064(0.170)
Tea labour cost	0.340***(0.068)	0.127*(0.070)	0.170***(0.051)
Tea input cost	0.317***(0.091)	0.245***(0.090)	0.180***(0.059)
Credit size	-0.711***(0.096)		
Off-tea farm businesses	-0.892***(0.167)		
Credit groups	0.500***(0.157)		
$\boldsymbol{ln\sigma_U}$		-0.012(0.066)	
$\boldsymbol{\rho_{U\varepsilon}}$		0.545***(0.176)	
$\boldsymbol{ln\sigma_{NU}}$			0.157(0.057)
$\boldsymbol{\rho_{NU\varepsilon}}$			0.467**(0.194)
Log likelihood	-684.21		
Wald test $(\mathbf{11})$ Prob>chi2=0.0000	117.10		
LR test of indep. Eqns. $\boldsymbol{\chi^2}(\mathbf{1})$=14.35 Prob>chi2=0.0008	14.35***		

***1% level of significance; **5% level of significance; *10% level of significance

The number of years in tea farming is linearly correlated with tea income for non-diverted credit and diverted credit farmers at 5 and 10 percent level respectively. This suggests that farmers' experience is related to technical efficiency of tea production that result from using credit accessed to procure farm inputs and labour for tea maintenance activities. The results are supported by Maniriho & Bizoza (2018) who showed that tea is a long-term cycle plant and its production can be improved by using input fertilisers and cumulative technical efficiency especially know how to harvest qualitative green leaves during plucking.

Training sessions on good agricultural practices for tea production is positive and significant determinant for tea income for both farmers' regimes. The results are plausible because technical efficiency is interconnected with the level of gained knowledge and skills by a farmer.

[3] Look for "diversion conclusion on Summary-desktop" Pakistan case

Therefore, it is not surprising that tea production is likely increased when farmers apply skills and knowledge acquired from attended training as supported by Muzari *at al.* (2012). However, training on credit management has no influence on gross margins for credit users. The finding shows that financial literacy is positive and significant for tea credit non-users farmers' regime. This is probably because of borrowing from formal sources requires to have certain level of knowledge on credit management specifically to minimize credit defaulting cases.

The findings also show that visits of officers from formal lending institutions is positively significant for effective credit utilization in particular for credit users. This is probably possible because this category of farmers spends maximum of their time for tea farm production activities and in most case, they live nearby tea production areas. The finding are supported by Uboh and Ekpebu (2011) who found that that the farmers visited by bank officials tend to assign more funds to the farm to mean that in the absence of such regular visits tend to tempt farmers to divert credit to unintended uses.

The cost of hired labour is positive and linearly correlated with the farm yield in both categories. A 1% increase in credit to pay for supplementary man day leads to 17% increasing income for the group of farmers that usually diverted credit to off-farm uses. The higher significant labour cost for this group implies the cost of delegating farm managers by landlords as these are busy for other businesses comparing to their counterparts whose tea production is a daily and primary occupation. Therefore, close management of hired labour for tea plucking determine the amount of credit to allocate for labour which is the case for tea credit users whose daily and primary occupation are tea farm production activities. However, the cost of input fertilisers is positive and significant (1% level) for both farmers' regimes because they are procured and supplied in bulk through the cooperatives if farmers have to benefit on subsidiary program for fertilizers by the central government. Similar to other findings, it was also expected that rate of farm input fertilisers application increases with tea plantation size which is also significant to influence tea income thus increase the size of tea plantations require additional capital for purchasing inputs (Emerole *et al., 2008;* Uboh and Ekpebu, 2011).

Factors of tea credit utilization

The ESR estimates show that the positive and significant variables of credit utilization for tea production are; the good agricultural practices, training on credit use and management, cost of labour and input fertilisers and access to joint/group credit. The significant and negative factors are; the size of accessed credit and possession of off-farm businesses.

The results confirm that farmers' participation in various trainings increases their commitment and determines the farmer's ability to allocate accessed credit (Caswell *et al.*,2001). Like explained above, labour for tea maintenance and plucking activities demand more capital for a farmer thus a higher probability of using accessed credit for tea production. The cost of input fertilisers also plays an important role to influence the farmers' decision for credit allocation. Farmers with higher cost of tea production are more likely to utilize accessed credit in purchasing related farm inputs.

Access to credit through farmers' cooperatives is positively significant at 1% level for both farmers' regimes. This is possible because farmers are recommended to procure subsidized fertilisers in bulk through their organizations through the government subsidy program for fertilisers. This supply chain approach is monitored by cooperative leaders who have the voice in determining the farmer' eligibility for the credit scheme based on his/her farm size and past performance on utilisation. In the most cases, the received fertilisers are later paid by deducting amount on supplied green tea leaves at the level of tea factories and farmers receive the balance.

Factors like size of credit amount and off-farm businesses are significant and negatively affecting the farmer's decision of utilizing credit for tea production projects and the level of tea farm income. Possession of off-farm businesses is here referred as a proxy of all possible sources of income out of tea enterprise. These include trading businesses or salaried jobs etc. Significantly, our expected negative effect of off-farm businesses on credit utilization for intended projects is a result of endogeneity between agricultural production and off-farm businesses investment as income diversification strategy indicated by Musafiri and Sjölander (2018). Farmers can also present tea plantations as collateral asset to access credit from formal lending sources mostly commercial banks and microfinances and later use it out of tea enterprise. Other factors are not significant and inconclusive to affect the decision of farmers to credit utilization.

Estimates of impact of credit from ESR results

As shown in Table 5, the impact of credit utilization for tea production is determined by differentiating column of non-diverted credit and that of diverted credit farmers. Cells (a) and (b) represent the expected tea income observed in the sample. The results reveal that the utilization of credit increases income for non-diverted credit compared with diverted credit farmers. The expected mean income per hectare per quarter for a tea household farmer that utilised credit for tea production is about 969,155 Rwandan francs, while it is about 563,714 Rwandan francs for those who diverted credit. Therefore, those who objectively invest in tea production earn about 405,441 Rwandan francs (72 percent) more than those who divert credit. The last column of the table (5) represents the treatment effect. For the counterfactual (c) case, tea household farmers who actually utilise credit gain 62,930 Rwandan francs (that is about 7 percent) more than if they diverted credit. While for counterfactual (d) case, tea household farmers that diverted credit, they would have realised about 312,411Rwandan francs (that is about 55%) more than if they utilise credit for intended projects for tea production.

Table 5: Impact of credit utilization on the tea farm income

	Utilization decision

Utilization status	Utilized	Diverted	Utilization effect
Tea HH farmers who utilized credit	(a)969,155	(c)906,224	ATT=62,930
Tea HH farmers who diverted credit	(d)876,125	(b)563,714	ATU=312,410***
Heterogeneity effect	93,030	342,510	TH=-249,480

The credit has significant and positive impact on farm outcomes if farmers effectively use it for tea production purpose. The estimates show that those who diverted credit they would averagely increase the gross margins by 55 percent. These results are particularly important to design effective credit utilization strategies to cope with potential impacts of tea production change. The findings are consistent with the literature that credit has positive and significant impact on farm yields and income (Riaz *et al.*, 2012; Awotide *et al.*, 2015; Ponguane, 2016 and Iddrisu *et al.*, 2017).

Conclusion and policy implication

The specific objective of the study was to analyse the effect of credit utilization on tea income among tea farmers in Nyaruguru District, Rwanda. And to assess whether credit utilization is a viable strategy in increasing green tea leaf production in the area. The study employed a purposive and random techniques to collect data through interview survey for tea farmers.

The results reveal that the causal effect of credit on tea income is significant regardless farmers' category. The covariance coefficients are positive and statistically significant, indicating that utilizing credit for tea production do not have the same effect between the two regimes of farmers; non-diverted and diverted credit farmers. Though results confirmed that farmers in both categories earn above-average return than that of a random individual from the sample would obtain but, in all cases, they are better off they are better off utilising credit for tea production. More specifically, farmers who actually utilise credit for tea production purpose earn 62,930 Rwandan francs per quarter per hectare equivalent to 7 percent more than if they diverted credit. However, the potential effect of credit utilization on tea farm income for those who divert credit is about 312,411 Rwandan francs per quarter per hectare. That is equivalent to 55 percent if they would utilise effectively credit accessed for tea production purpose.

Determinants of farmers' decision toward effective credit utilization include age, size of owned tea plantation, experience in tea farming, training on tea good agricultural practices and credit management, visits of bank officials, cost of input fertilisers and labour and group credit as well. However, larger credit and in cash and off-farm businesses negatively affect the level of tea farm income.

There is a need to make sure that all agricultural credit be utilized for the same purpose for which it was obtained. To reach there, policies and programs would enhance the provision of agricultural credit in kind mainly as physical inputs and be channelized through farmers' cooperatives to discourage credit diversion.

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Notes

1. Tea gross margins was estimated as the amount in Rwandan Francs (exchange rate stood at US$ 1.00=FRW 950.00 July 2019) paid for supplied tea green leaves by a farmers per hectare per quarter.

2. Interested readers can consult Access to Finance, Rwanda and Agro-input subsidy program by the government of Rwanda.

References

1. Abedullah N., Khalid M. and Kouser S. (2009). The role of agricultural credit in the growth of livestock sector: A case study of Faisalabad. *Pakistan Vet. J*, 29(2), 81-84.
2. Adego T., Simane B. and Woldie G. A. (2019). The impact of adaptation practices on crop productivity in northwest Ethiopia: an endogenous switching estimation. *Development Studies Research*, 6(1), 129-141.
3. Alvarez N. L. and Naughton-Treves L. (2003). Linking national agrarian policy to deforestation in the Peruvian Amazon: a case study of Tambopata, 1986–1997. *AMBIO: A Journal of the Human Environment*, 32(4), 269-274.
4. Amsalu A.and De Graaff J. (2007). Determinants of adoption and continued use of stone terraces for soil and water conservation in an Ethiopian highland watershed. *Ecological economics*, 61(2-3), 294-302.
5. Awotide B. A., Abdoulaye T., Alene A. and Manyong V. M. (2015). *Impact of Access to Credit on Agricultural Productivity: Evidence from Smallholder Cassava Farmers in Nigeria*. (No. 1008-2016-80242).
6. Bashiru M., Dumayiri M. and Sabutey G. T. (2014). Analysis of the sources of Farm investment Credit in the Upper West region of GHANA. *International Journal of Current Research and Academic Review* 2 (5) *1*, *15*.
7. Bekun F. V., Hassan A. & Osundina O. A. (2018). The role of agricultural credit in agricultural sustainability: dynamic causality. *International Journal of Agricultural Resources, Governance and Ecology*, 14(4), 400–417.
8. Di Falco S., Veronesi M. and Yesuf M. (2011). Does adaptation to climate change provide food security? A micro-perspective from Ethiopia. *American Journal of Agricultural Economics*, 93(3), 829-846.

9. Emerole C., Nwosu A., Onyenweaku C., Ukoha O. and Nwachukwu A. (2008). Determinants of consumption expenditure and its share to total income in small farm households in Ikwuano, Abia state Nigeria. Global Approaches to Extension Practice: *A Journal of Agricultural Extension*, 3(1), 1–11.
10. Essama-Nssah B., Ezemenari K. and Korman V. (2008). *Reading Tealeaves on the Potential Impact of the Privatization of Tea Estates in Rwanda*. The World Bank
11. FAO. (2020). FAOSTAT. Available at: FAOSTAT.
12. Feder G., Lau L. J., Lin J. Y. and Luo X. (1990). The Relationship between Credit and Productivity in Chinese Agriculture: A Microeconomic Model of Disequilibrium. *American Journal of Agricultural Economics*, 72(5), 1151–1157.
13. Freeman H. A., Ehui S. K. and Jabbar M. A. (1998). Credit constraints and smallholder dairy production in the East African highlands: Application of a switching regression model. *Agricultural Economics*, 19, 33–44.
14. Fuglie K. and Rada N. (2013). Resources, policies, and agricultural productivity in sub-Saharan Africa. *USDA- ERS Economic Research Report* (145)
15. Government of Rwanda. 2012. Rwanda: Financial Sector Development Program II (2013–2017). Kigali, Rwanda.
16. Greene W. H. (2002). Econometric Analysis. (5th Ed.). New York: Prentice Hall.
17. Heckman J. J. (1979). Sample Selection Bias as a Specification Error. *Econometrica*, 47 (1), 153– 61.
18. Hussan T. (2013). *Factors influencing demand for credit from formal and informal sources in Gujranwala district, Pakistan- a case of commercial banks and arties*. A Masters's thesis, Norwegian University of Life Sciences.

19. Iddrisu A., Ansah I. G. K. and Nkegbe P. K. (2018). Effect of input credit on smallholder farmers' output and income: Evidence from Northern Ghana. *Agricultural Finance Review,* 78(1), 98–115.

20. Kanburi Bidzakin J., Fialor S. C., Awunyo-Vitor D. and Yahaya I. (2019). Impact of contract farming on rice farm performance: Endogenous switching regression. *Cogent economics & finance*, 7(1), 1618229.

21. Langyintuo A. S. and Mekuria M. (2005). *Accounting for neighbourhood influence in estimating factors determining the adoption of improved agricultural technologies* (No. 378-2016-21410).

22. Lee L.F. (1982). Some Approaches to the Correction of Selectivity Bias. *Review of Economic Studies* 49 (3), 355–72.

23. Lokshin M. and Sajaia Z. (2004). Maximum likelihood estimation of endogenous switching regression models. *The Stata Journal,* 4(3), 282-289.

24. Maddala G. S. (1983). Methods of estimation for models of markets with bounded price variation. *International Economic Review*, 361-378.

25. Malimba M. and Ganesan P. (2010). Financial Services Consumption Constraints: Empirical evidence from Rwandan Rural Households. *Journal of Financial Services Marketing,* 15(2), 136–159.

26. Maniriho A. and Bizoza A. (2013). Financial Benefit-Cost Analysis of Agricultural Production in Musanze District (Rwanda). *Acad Arena*, 5(12), 30-9.

27. Miguel E. and Michael K. (2004). Worms: Identifying Impacts on Education and Health in the Presence of Treatment Externalities. *Econometrica,* 72 (1), 159–217.

28. MINAGRI. 2012. *Cabinet Briefing Paper: New tea green leaf pricing model to tea farmers in Rwanda.* Kigali, Rwanda.

29. Muhongayire W., Hitayezu P., Mbatia O. L. and Mukoya-Wangia S. M. (2013). Determinants of Farmers' Participation in Formal Credit Markets in Rural Rwanda. *Journal of Agricultural Sciences,* 4(2), 87–94.

30. Musabanganji E., Antoine K. and Lebailly P. (2015). Determinants of access to agricultural credits for small-scale farmers in the Southern Province of Rwanda. In *Book of Proceedings Sixth International Scientific Agricultural Symposium "AgroSym 2015"* (pp. 1815-1820).

31. Musafiri I. and Sjölander P. (2018). The importance of off-farm employment for smallholder farmers in Rwanda. *Journal of Economic Studies,* 45(1), 14–26.

32. Muzari W., Gatsi W. and Muvhunzi S. (2012). The Impacts of Technology Adoption on Smallholder Agricultural Productivity in Sub-Saharan Africa: A Review. *Journal of Sustainable Development,* 5(8), 69.

33. NAEB. (2019). *NAEB strategic plan 2019-2024: Increasing Agri-export revenues.* Kigali, Rwanda.

34. Nguyen-Van P. (2016). Technical efficiency and agricultural policy: evidence from the tea production in Vietnam. *Review of Agricultural, Food and Environmental Studies*, 97(3), 173-184.

35. Oboh V. U. and Ekpebu I. D. (2011). Determinants of formal agricultural credit allocation to the farm sector by arable crop farmers in Benue State, Nigeria. *African Journal of Agricultural Research,* 6(1), 181–185.

36. Ponguane S. J. A. (2016). *Effects of credit subsidy on smallholders maize productivity and farm income in Chókwè District, Mozambique.* A master's thesis, Egerton University, Kenya.

37. Republic of Rwanda. (2013). *Economic Development and Poverty Reduction Strategy II 2013 - 2018: Shaping Our Development.* Kigali Rwanda.

38. Reza S. N. S. M., Fathollah T. and Karim A. (2017). *Affecting factors on credit diversion in Iran*, 25(81), 187–228.
39. Riaz A., Khan G. A. and Ahmad M. (2012). Utilization of agriculture credit by the farming community of ZARAI TARIQIATI BANK Limited (ZTBL) for agriculture development. *Pakistan Journal of Agricultural Sciences*, 49(4), 557–560.
40. Shiferaw B., Kassie M., Jaleta M. and Yirga C. (2014). Adoption of improved wheat varieties and impacts on household food security in Ethiopia. *Food policy*, 44, 272-284.
41. Vedamurthy K. B. (2014). Dairy credit utilisation and repayment in Shimoga milk zone of Karnataka: A comparative analysis of SHGs, Commercial Banks and RRBs. *Indian Journal of Dairy Science*, 67(4).
42. World Bank. (2013). *Impact evaluation of tea sector reforms in Rwanda baseline household survey* (Issue October).
43. World Bank. (2018). *Agriculture Finance Diagnostic Rwanda*. 1-60