



ACCESS TO FINANCE AND AGRICULTURAL PRODUCTIVITY: EXPERIENCE OF WATERMELON PRODUCE AMONG THE SMALL FARMERS IN BUGESERA AND KAYONZA DISTRICTS, EASTERN PROVINCE, RWANDA.

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ABSTRACT

Access to finance is critical to commercial agricultural productivity among small scale farmers. However, most of the small scale commercial farmers in Rwanda, like in many Sub-Saharan Africa (SSA) countries have limited access to finance. Even among those who had access to finance, it is unclear whether it has any significant impact on their productivity. This study therefore aims to assess the effect of access to finance on watermelon productivity. Specifically, the study aims to analyze the effect of the access to credit on watermelon productivity among small scale farmers in Bugesera and Kayonza Districts, assess the effect of Nkunganire (Government Subsidy) programme on watermelon productivity among small scale farmers in Bugesera and Kayonza Districts and finally evaluate the effect of income from the sale of previous watermelon production on productivity of the last agricultural season. Primary data were collected from 109 watermelon growers in Bugesera and Kayonza districts. Descriptive statistics and linear regression analysis were used to analyze data. The results of this study evidenced that access to credit as well as access to Nkunganire (Government Subsidy) programme have a positive and significant effect on watermelon productivity in the study areas, a 1 unit increase in the farm income from the previous sales of watermelons has increased the farm productivity of small-scale watermelon farmers in the study areas by about 0.882 units or 88% of water melon productivity. It is concluded that access to finance has had an effect on agricultural productivity among the small farmers in Bugesera and Kayonza Districts. This study recommends that small-scale farmers should be encouraged and facilitated by the government to access Finance in order to improve productivity.

Key words: Access to finance, agricultural productivity, watermelon.

1.1. Introduction

Many developing countries are committed to transforming their agriculture sector from Subsistence towards higher market oriented agriculture which would have an impact not only on small scale farmers but also on other sectors of the economy. Transformation of the subsistence agriculture to production for the market is a precondition for welfare improvements and material wealth of the small scale farmers in developing countries in general and in SSA in particular where agriculture remains to be the mainstay for a large segment of the population (Langyintuo, 2020). In such a transformation process, agricultural finance has an imperative role to play. This is because; the shift from subsistence to commercialized agriculture production necessitates substantial resources to cover ongoing modern farming expenses. It is the transition to a state of maximization of agricultural productivity potential. Access to finance actually allows small holder farmers facing many competitive spending priorities to use more resources to maximize their productivity potential.

More importantly, access to finance by small scale farmers would secure them insurance to control marketing and production risks and to help them to respond accurately to climatic shocks (Awunyo-Vitor, 2018). This is because smallholder farmers' responses to all of these depend on increased on-



farm investments, such as appropriate seeds and fertilizers, irrigation, mechanization, and reductions in postharvest losses. Consequently, increasing production through efficient use of resources is an important tactic along with diversification (Dixon et al., 2001).

Increasing agricultural productivity entails capital-intensive irrigation (CII) and mechanization like many SSA countries, both potentials have not been fully realized in Rwanda. The low rate of adaptation for CII is explained by the lack of access to financing. This is because the ability of small scale farmers to transition or to adapt to MFT should be further determined by access to finances. The latter allow small farmers, especially those with little or no equity capital, access to up-to-date resources. Thus, insufficient access to finances deprives small scale farmers of the opportunity to farm according to modern principles. More generally, the lack of access to finance is considered to be one of the main reasons most farmers in SSA remain in small-scale subsistence farming. Combarry (2022), shows that financial constraints lead to sub-optimal use of smallholder farmers' resources, resulting in a backlog productivity potential of approximately 25 percent. Finance is therefore the biggest challenge for the development of agricultural sector and developing countries. Indeed, evidence shows that, in most countries, sustained agricultural growth in the early stages of development was important for rapid economic growth and poverty reduction in industrialized countries (Lains&Pinella, 2010).

The most recent example is the Green Revolution in Asia, where the introduction of modern technology in agriculture led to an increase in agricultural productivity and thus yield, which facilitated fuel overall economic growth and improve the living standards of the small scale farmers (Mendola, 2007). This is to mean that, the success of agricultural sector creates the conditions for the development of the non-farm economy and the increase of off-farm income, which in turn stimulate further agricultural growth in the country in question. Thus, the challenge facing Rwanda is to access finance and invest in productivity-driven base for competitive market oriented agriculture over the long-term. Although there is a strong demand for substantial and sustainable financing of modern commercialized agriculture, past empirical research on this issue in Rwanda and in many developing countries has been limited to family farms (Houensou, Goudjo, &Senou, 2021; Awotide, Abdoulaye, Alene, &Manyong, 2015, Seven, & Tumen, 2020; Fowowe, 2020; Girabi, &Mwakaje, 2013; Sekyi, Domanban, &Honya, 2019; Rahman, Hussain, &Taqi (2014; Owusu, 2017) to name a few. Family farming is increasingly interested in providing for family necessities rather than to make money for extras. Additionally, past studies have assumed homogeneity of family farming and commercial agriculture which could lead to erroneous results. Therefore, more studies are needed on a case by case basis, especially with regard to the productivity of watermelon produce, to adopt a reliable policy conclusions.

1.2. Statement of the problem

The acquisition and effective use of optimal resources (labour, capital and technologies) are among the factors that affect the agricultural productivity. The optimal combination of these inputs is the key to taking full advantage of agricultural productivity potential. The latter is the most reliable and fastest way to improve the living standards of smallholder farmers in Rwanda, which are now widely available. In their study, Thirtle et al., (2003) found that increasing agricultural productivity, or crop yields, could reduce the number of poor people in Africa by 72%. This is consistent with the findings of Von Braun et al. (2008), who argue that poverty reduction and food security in low income countries can be achieved through increased agricultural productivity, which requires substantial and sustained access to finance to introduce new and improved technologies especially small farmers. However, access to agricultural finance to realize this potential, among small scale farmers, has been



a critical issue in Rwanda as in many other African countries (Ali, Deininger, & Duponchel, 2014; Chisasa & Makina, 2012). Even the one that has been provided, it is not much clear whether it has any significant impact on small scale farmers productivity. As a result, this study was conducted to determine whether access to finance among Rwanda's small scale farmers have paid off in terms of improving watermelon productivity and thus yields.

1.3. Objectives of the study

The main objective of this study is to assess the effect of access to finance on watermelon productivity in Bugesera and Kayonza Districts, in Eastern Province, Rwanda.

The Specific objectives include:

- a) To analyze the effect of credit on watermelon productivity among small scale farmers in Bugesera and Kayonza Districts.
- b) To assess the effect of Nkunganire (Government Subsidy) programme on watermelon productivity among small scale farmers in Bugesera and Kayonza Districts.
- c) To evaluate the effect of income from previous sales of watermelons on last watermelon productivity season in Bugesera and Kayonza Districts.

1.4. Research hypotheses

This study adopted Null hypotheses as follows:

H₀₁: There is no effect of credit on watermelon productivity among small scale farmers in Bugesera and Kayonza Districts.

H₀₂: There is no effect of Nkunganire (Government Subsidy) programme on watermelon productivity among small scale farmers in Bugesera and Kayonza Districts.

H₀₃: There is no effect of income from previous sales of watermelons on last watermelon productivity season in Bugesera and Kayonza Districts.

2. Literature Review

2.1. Theoretical literature

The researchers elaborated on access to finance including access to credit, access to Nkunganire (Government Subsidy) and use of income from the previous sale and their relationship with agricultural productivity with reference to watermelon produce in Easter province (Bugesera and Kayonza Districts) .

2.1.1. Concept of agricultural finance

According to Zuberu, Ari, & Iliya, (2019) agricultural finance is the acquisition and use of capital in agriculture. It deals basically with the supply and the demand for funds in the agricultural sector of the economy. In this study, agricultural finance mean access to the credit, Nkunganire (Government Subsidy) programme and use of income from previous sales of watermelons whose purpose can directly be linked to small scale watermelon farming activities in the study areas. That is, the money borrowed from financial institutions and the support from government through Nkunganire (Government Subsidy) programme to support watermelon (agricultural) production. According to



Bizoza, Nkurukiye, & Byishimo, (2018), Nkunganire (Government Subsidy) refers to the distribution system of agricultural inputs such as seeds and fertilizers at a subsidized price.

2.1.2. Concept of the small scale farmer

Agricultural production systems in developing countries are largely based on small scale farmers. The latter are defined as farming two or less ha, and represent 80% of all farms in SSA, and contributed up to 90% of the production in some SSA countries, (Wiggins 2009). A greater segment of these are women, accountable for key components of household production namely weeding; harvesting; and processing. Small scale farming activities are characterized by low endowment in production factors, like land; water etc. relative to other farmers in the sector, (Bragdon, & Smith, 2015).

2.1.3. Need of finance by agricultural farmers

Access to finance is imperative to the maneuvers of the agricultural sector, especially with (1) the diversification of agricultural exports, (2) the shift from extensive to intensive farming production as well as from subsistence agriculture to commercial one. This is because without access to finance, small scale farmers would struggle to emerge, for example, from subsistence to commercialized agriculture production or from extensive to intensive agricultural production. According to Carter (1989), access to finance/credit, affects the performance of agriculture via an efficient allocation of resources as it helps small scale farmers to overcome financial constraints. The author stressed that “this sort of effect will shift the farmers along a given production line to a more remunerative input combination line. Agricultural finance is used to acquire new packages of technology that are high yielding and resilient to diseases. It also helps with the marketing and transportation of yields. Access to finance for small scale farmers would also enable them to respond accurately to climate shocks (Awunyo-Vitor, 2018).

2.1.4. Agricultural productivity

Measurement of both agricultural productivity and access to finance is very important for this study. The quantities of output relative to the quantity of inputs are the conventional measures of productivity. Dewett and Singh (1966) define agricultural productivity as the varying relationship between agricultural output and one of the major inputs, while holding other complementary factors the same. In this study, we measure watermelon productivity as the ratio of income to the average size of the land cropped. The latter is considered to be critical for measuring agricultural productivity. Access to credit, to Nkunganire (Government Subsidy) programme and higher income from previous sales of watermelon are considered dichotomous variables, as a result, they will take “1” if a farmer had access to credit and/or benefited from Nkunganire (Government Subsidy) programme or had higher income from previous watermelon sales and “0” otherwise.

2.1.5. Hypothesized Factors to affect agricultural productivity

A majority of the researchers has given attention to the function of orthodox inputs like labor and capital (improved crop varieties, fertilizers and, seeds etc.) in explaining the productivity growth (Frisvold, & Ingram, 1995, Mozumdar, 2012). Along with the above factors the role of research and technological development, public investment in agricultural research, access to extension services, financial services and infrastructural development, sustainable natural resources management, etc. were also found to be closely linked to agricultural productivity (Mozumdar, 2012). According to Jayne, et al., (2021) changes in total factor productivity (TFP) are driven by both innovations and technological change. Demographical variables were also found to be very closely associated with agricultural productivity (Wirakusuma, & Irham, 2021).



2.2. Empirical Review

In this study, the researchers reviewed some of the relevant empirical studies of the impact of finance on agricultural productivity. First, Houensou, Goudjo, & Senou, (2021) analyzed the nexus between financial access and small family farm productivity and concluded that that financial access was positively correlated with small farm productivity. In Benin, it increased by 15%. Small family farms saw a 13% increase in productivity, a significant result. The study argues that introducing financial support policies to make small farms more productive and more conducive to agricultural growth is highly suggestive in the field of research.

Ali, Deininger, & Duponchel, (2014) by using an endogenous switching model, analyzed the nexus between credit constraints and agricultural productivity among Rwandan rural households and their findings point out that credit rationing in Rwanda is widespread and that it affects the efficiency of agricultural production. The magnitudes involved are by no means trivial; exogenously lifting constraints to finance is estimated to have the potential of increasing yields by at least 17 per cent.

Awotide et al. (2015) employed an Endogenous Switching Regression Model (ESRM) to evaluate the impact of financial access on agricultural productivity in Nigeria and found that financial access is positively and significantly associated with cassava productivity. Consequently, this study recommends that lenders consider extending FSs to rural farms so that more households can benefit.

Seven, & Tumen (2020) by using country-level data (covering 104 countries for the 1991-2014 period) explored the aggregate linkages between agricultural finance and productivity and found that financial access has a positive impact on agricultural productivity. Specifically, they found that doubling agricultural funds would increase agricultural productivity by about 4-5 percent.

Girabi, & Mwakaje (2013) investigated the impact of MFIs on smallholder farm productivity based on sunflower and maize and found a significant difference in input use and farm productivity between those who used credit (credit beneficiaries) and those who did not use credit to finance some of their farming activities (no-credit beneficiaries), whereby the farm productivity by the former group was persistently high compared to the latter. Their results highlighted that input use (fertilizers, improved seeds and hired labor) had positive and significant impact on agricultural productivity.

Sekyi, Domanban, & Honya (2019) by employing the endogenous switching regression (ESR) model, looked into the impact of informal credit on rural agricultural productivity in the savannah ecoregion of Ghana and demonstrate that access to such informal credit significantly improves agricultural productivity in the study area. Specifically, a farmer with informal credit was able to harvest 48.42 kg/ha more than a farmer without informal credit. In terms of the counterfactual, farmers without informal credit access would increase yield by 57.61 kg/ha if they had access to informal credit.

Rahman, Hussain, & Taqi (2014) studied the effect of agricultural credit on agricultural productivity in Pakistan and found a positive relationship between credit and agricultural productivity. This means that loans allow farmers to purchase seeds, fertilizers and pesticides of superior quality or high yielding varieties, which in turn increase yields. This study suggests that providing farmers with the right amount of credit at the right time can help increase the productivity of Pakistani agriculture.



Owusu (2017) studied the effect of the access to credit on cassava productivity in the Afigya-Kwabre region of Ghana and the results of this study show that that credit has a positive and significant impact on cassava productivity. The study recommends that interventions to improve agricultural productivity in the study area should first consider access to finance (credit).

Taremwa et al., (2021) studied the relationship between agricultural credit access on agricultural productivity among maize and rice smallholder farmers in Rwanda and their findings suggests that access to agricultural credit had an impact on the productivity of smallholder maize and rice farmers in the Eastern and Western provinces of Rwanda. However, it was observed that this impact, though, is still sub-optimal, as the difference in yields among farmers with access to credit and farmers without access to credit was about 440 kilograms per tonne. That is, for every tonne produced by farmers without credit access, farmers with credit access produce only 440 kg more than those who did not receive credit. The study suggests that Rwanda's government and agricultural policy-makers should develop ways to increase the productivity of corn and rice farmers by improving their access to agricultural credit.

2.3. Theoretical framework

This part highlights different theories and models pertaining the access to finance and productivity including Financial intermediation theory, Pecking order theory and Static Trade-off Theory.

2.3.1 Financial intermediation theory (FIT)

The FIT argues that financial intermediaries (FIs) are expected to increase productivity through funding investments, and economies are expected to grow faster if they can earn better returns on these investments. Productivity is central to this theory (King, & Levine 1993). FIs provide a mechanism for pooling funds to conduct an indivisible business on a large scale (Merton, 1995). FIs are the main determinant of real growth rates. It is through the efficiency of resource allocation that this is achieved. That means that the services provided by FIs, such as granting credit to farmers, are essential for technological innovation and thus higher productivity per unit area of land. More generally, FIs enable efficient resources allocation by allowing smallholder farmers (investors) to benefit from the advantages of large-scale investment projects (Sinha, 2001).

2.3.2 Pecking order theory (POT)

The need of POT becomes important since the information available to investors/farmers is asymmetric and they find it problematic in making a choice between external and internal financing. This theory proposes that the cost of financing rises with asymmetric information and that financing comes from three sources namely internal, debt and equity financing. POT is of the view that internal fund (retained earnings) are more suitable than debt financing. Moreover debt financing is better than equity financing because cost of the debt is much lesser than the cost of equity. Specifically, POT sets the hierarchical level of the organizations for their financing decisions. Therefore, investors must first recourse to internal financing, then to debt and finally to equity. A key benefit of POT is improving the ability of financial managers to help maximize profits and maintain control over the company by minimizing capital costs and agency problems (Frank, & Goyal, 2003, Sánchez-Vidal, & Martín-Ugedo, 2005, and Cotei, & Farhat, 2009).

2.3.3 Static Trade-off Theory (STT)

The basic concept of STT is to minimize the cost of capital through adequate debt and equity financing. Businesses are financed in part by debt and equity and the main advantage of debt finance is the tax benefit of this debt, while on the other hand, the disadvantage of debt finance is the cost of debt. The STT argues that in order to strike a balance between the pros and cons of debt and equity



finance, firms should choose maximized types of finance (Butt, Khan, & Nafees, 2013 and Cotei & Farhat, 2009). Smallholders use these theories as key strategic tools to increase agricultural productivity. This is mainly due to the basic principal that farmers’ choices are linked to the increase in agricultural productivity.

The implication of the above theories are that access to credit would increase the willingness of small scale farmers to adopt input usage levels closer to their potential when capital is not a constraint, and thus leading to higher levels of productivity, taking into account fixed resources such as land. Specifically, access to credit (external financing with either debt or equity or both) can affect agricultural productivity, as capital constrained farmers are more likely to use lower levels and combinations of inputs than farmers whose production activities are not capital constrained. Therefore, access to credit can significantly increase the ability of small scale farmers with little or no savings to meet their financial needs for agricultural inputs.

2.3. Conceptual framework

The conceptual framework about access to finance and the agricultural productivity as follows:

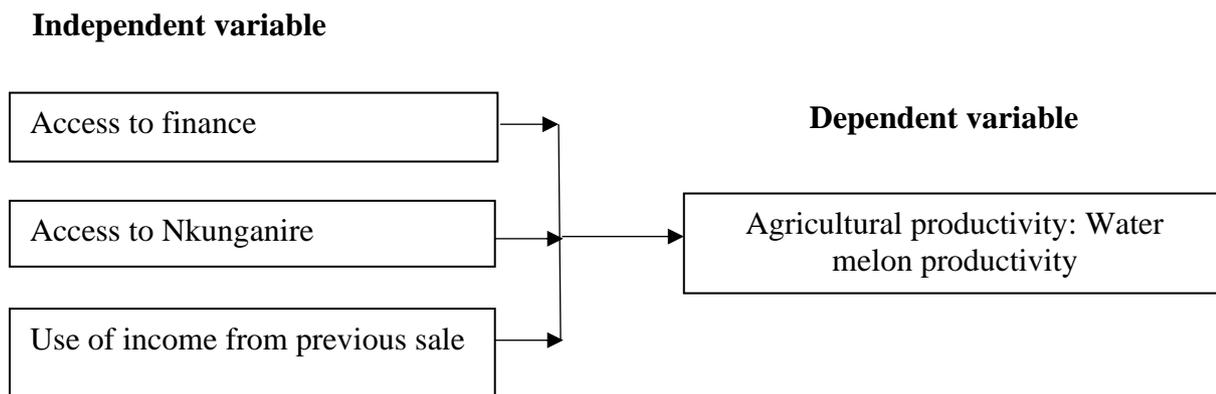


Figure1: Conceptual framework
Source: Adopted by the researchers (2022)

The Figure 1 shows the interdependence between the independent variable and dependent variable. Independent variable include Access to credit, access to Nkunganire (Government Subsidy) and use of Income from the previous sale and dependent variable include Agricultural productivity with reference to water melon produce. The access to finance is believed to increase the agricultural productivity with reference to increase of the productivity of watermelon.



3. Research design and methodology

Bhattacharjee (2012) defined the research design as the specification of techniques and methodologies that are used to acquire the needed information. This study used Cross-Sectional Surveys (CSS) in which data were collected at one point in time from a sample selected to represent a larger population (Owens, 2002). The farmers from two districts Kayonza and Bugesera from easter province were selected. These districts are characterized by numerous lakes, the biggest of which are Rweru and Cyohoha in Bugesera, and small interior lakes such as Ihema, Rwibishuhe, Kabigabiro and Cyabatanzi, Kibare, Shakani, Kivumba, Hago, and Muhazi in Kayonza. These lakes make these two districts special for watermelon cultivation. In particular, these lakes ensure that watermelons get enough of water, especially during dry periods. Therefore, the study population of this study, that is, watermelon farmers, is 109. The researchers took all to participate in this study and they also make a sample size.

Data were collected by use of questionnaire, documentary analysis and interview. Reliability of research instruments was ensured using test-retest method along with reliability coefficient (0.80) Bless and Higson-Smith (2000), Validity was tested and confirmed using Content Validity Index (CVI)(0.70) (Amin, 2005). Socio-economic characteristics of respondents were summarized using descriptive statistics. Linear regression analysis was used to analyze the effect of access to credit, Nkunganire (Government Subsidy) programme and income from previous sales of watermelons on watermelon productivity among small scale farmers in the study area.

The Multiple Linear regression model was used to test the relationship between one regress (Y) and one or more predictor variable(s) (X). This is derived as follows:

$$Y = \beta_0 + \beta_1ACRT + \beta_2ANK + \beta_3PI + u , \dots \dots \dots (1)$$

Where:

Y: agricultural productivity (AP) (dependent variable)

β_0 =Constant/intercept

$\beta_1 - \beta_3$ =Regression coefficients of access to finance

ACRFT =Access to credit

ANK =Access to Nkunganire (Government Subsidy)

PI =Income from previous sales

u= Error term (Extraneous Variables)

4. Findings and discussions

The purpose of this study was to analyze the effect of access to finance and agricultural productivity taking watermelon produce as a case study. This section provides the analysis and interprets the data which were collected in line with the research objectives.

4.1. Demographic description of the respondents

The information about the respondents including gender, access to credit, access to Nkunganire and use of Income from the previous sale was gathered and is presented below:

Table 1. Background information of the respondents

| Details | Gender | Frequency | Percent | Valid Percent | Cumulative Percent |
|---|--|------------------|----------------|----------------------|---------------------------|
| Gender of the respondents | Female | 24 | 22.0 | 22.0 | 22 |
| | Valid Male | 85 | 78.0 | 78.0 | 100 |
| | Total | 109 | 100.0 | 100.0 | |
| Access to credit | Access to credit | Frequency | Percent | Valid Percent | Cumulative Percent |
| | Yes | 20 | 18.3 | 18.3 | 18.3 |
| | Valid No | 89 | 81.7 | 81.7 | 100.0 |
| Total | 109 | 100.0 | 100.0 | | |
| Access to Nkunganire (Government Subsidy) | Access to Nkunganire (Government Subsidy) | Frequency | Percent | Valid Percent | Cumulative Percent |
| | Yes | 52 | 47.7 | 47.7 | 47.7 |
| | Valid No | 57 | 52.3 | 52.3 | 100.0 |
| Total | 109 | 100.0 | 100.0 | | |
| Use of income from previous sales | Use of income from the previous sale | Frequency | Percent | Valid Percent | Cumulative Percent |
| | Use previous income | 31 | 28.4 | 28.4 | 28.4 |
| | Valid Does not save for next Agri season | 78 | 71.6 | 71.6 | 100 |
| Total | 109 | 100 | 100 | | |

Source: Primary data, 2022

The results in Table 1 details the information on gender, access to credit, access to Nkunganire (Government Subsidy) and status of the respondents about the use of income from previous sales of their agricultural produce. The respondents consisted of 85 males (78%) and 24 females (22%) (N=109). It was realized that men are more interested in watermelon farming practices in the study areas than women.

The Table 1 indicates that those who have access to credit either from the bank or from microfinance institutions are only 20 (18.3%) while 89 (81.7%) did not have access to credit. The lower credit access rate in the study areas is due to the reluctance of FIs to provide loans to these farmers because they view agriculture as a vulnerable business. More precisely, the respondents cited high cost of borrowing, double-risk avoidance, and constraint of collateral as the major factors limiting access to credit in the study areas. The results revealed that 18.3% have access to Nkunganire (Government Subsidy) while the majority of the farmers as shown by 81.7% of the respondents do not have access.



The researchers found that 28.4% have saved money from the previous sale of the produce so that they use it for the next season as a way to expand their agricultural activities. It was also found that 71.6% fail to save the money from the previous sales.

4.2. Regression Model Summary/Coefficient of the determination

The model summary has been extracted to show the significance of dependent variable being agricultural productivity with reference to watermelon produce to be influenced by the independent variables being access to finance in its facets: Access to credit, access to Nkunganire (Government Subsidy) and use of incomes from the previous sale.

Table 2: Model Summary

| Model | R | R Square | Adjusted R Square | Std. Error of the Estimate | Durbin-Watson |
|-------|------|----------|-------------------|----------------------------|---------------|
| 1 | .933 | .871 | .866 | .11780 | 1.723 |

a. Predictors: (Constant) ANK1, ACRDT1, log10_PI

b. Dependent Variable: log10_AP

Source: Primary data, 2022

The coefficient of multiple determinations being 0.866 (Table 1) shows that about 86.6% of variation in agricultural productivity of the smallholder farmers in the study areas is explained by the independent variables/predictors variables included in the model. The regression equation is very useful for making predictions because the value of R-Square (R^2) is close to 1. That is, the main predictors of productivity have been included in the model. The Durbin-Watson (DW) statistic measuring autocorrelation showed no evidence of autocorrelation because the statistics of DW (1.723) was within the acceptable range for no autocorrelation. The acceptance range of the DW statistic without autocorrelation is from 1.45 to 2.44.

4.3. Normal distribution test

The ANOVA was used to test the model fitness to predict the relationship between the dependent and the independent variable.

Table 3: ANOVA

| Model | | Sum of Squares | Df | Mean Square | F | Sig. |
|-------|------------|----------------|-----|-------------|---------|------|
| 1 | Regression | 9.720 | 4 | 2.430 | 175.112 | .000 |
| | Residual | 1.443 | 104 | .014 | | |
| | Total | 11.163 | 108 | | | |

a. Predictors: (Constant), SLC, ANK1, ACRDT1, log10_PI

b. Dependent Variable: log10_AP

Source: Primary data, 2022

The results in Table 3 measure the overall significance of the original model. The results indicate that the overall regression model has a high significance for the data and this is recorded by the ANOVA F-statistic) value of 175.11 and its associated probability value of 0.000 ($F(4,104)=175.11, P(0.00)<0.05$).

4.4. General Overview/ General model

The researchers wanted to determine the influence of each predictor on the prediction in the presence of other predictors already in the model. In checking the significance of the partial regression coefficients, there was a need to test each relationship separately using the individual P-value. The results are in the Table below:

Table 4: Coefficients predictors of Access to finance and agricultural productivity

| Model | Unstandardized Coefficients | | Standardized Coefficients | T | Sig. | Collinearity Statistics | |
|------------|-----------------------------|------------|---------------------------|--------|------|-------------------------|-------|
| | B | Std. Error | Beta | | | Tolerance | VIF |
| (Constant) | .591 | .111 | | 5.308 | .000 | | |
| 1 ACRDT1 | .066 | .033 | .040 | 2.00 | .049 | .780 | 1.282 |
| ANK1 | .059 | .029 | .074 | 2.005 | .048 | .912 | 1.097 |
| log10_PI | .882 | .036 | 1.009 | 24.783 | .000 | .749 | 1.335 |

a. Dependent Variable: log10_AP

Source: Primary data, 2022

Since the regression model contains more than one predictor variable, the unstandardized coefficients were interpreted. Regarding the effect of access to credit (ACRDT), the dummy variable for access to credit (ACRDT1=1), is regressed on agricultural productivity by referring to credit inaccessibility (ACRDT0=0). The estimated coefficient of the dummy variable for ACRDT1=1 is positive (0.066) and statistically significant at the 5% level of significance ($P(0.049) < 0.05$). This shows that credit access has a greater impact on agricultural productivity of small scale farmers in comparison with farmers without credit access. In other words, the productivity of small scale farmers using credit is higher than that of farmers without access to credit. This result is consistent with financial theory and is also consistent with the findings of Adewale, et al., (2022), and Seven & Tumen, (2020) who found that agricultural credit has a significant positive impact on agricultural productivity. Indeed, according to Mohsin, Ahmad & Anwar (2011), access to credit is the driving force for the adoption of new agricultural technologies that would increase agricultural productivity. Therefore, an agricultural credit is very important and should be expanded and developed widely to small scale farmers. In particular, the findings support the argument that agricultural credit services should be a key component of interventions to improve the productivity of watermelon farmers in Rwanda. However, the magnitude of the impact is statistically small looking at the difference between the coefficient of the dummy variable for access to credit (ACRDT=1) and no access to credit (ACRDT0=0) is 0.066. The low impact of agricultural credit can be attributed to a number of reasons including high interest rates, reluctance by Financial Institutions to offer credit on agriculture, etc. These obstacles can be overcome by introducing agricultural insurance schemes, ensuring fair market prices, especially for watermelons and agricultural products in general, and increasing yields in agricultural industry.

The estimated coefficient of the dummy variable for the access to Kunganire (ANK1=1) is positive (0.059) and statistically significant at the 5% significance level ($P(0.04) < 0.05$) (Table 4). This implies that the Nkunganire (Government Subsidy) programme has a significant higher impact on agricultural productivity than other agricultural inputs. Rational use of agricultural inputs such as improved seeds and inorganic fertilizers has been identified as one of the ways to increase agricultural productivity. However, these resources may not be financially available or attractive to small-scale



farmers (Hemming, et al., 2018). Alternatively, Nkunganire (Government Subsidy) aim to provide these inputs to small-scale farmers at below market prices in increasing agricultural productivity and thus improve the livelihood of stallholder farmers. However, it can be said that the dummy coefficient (ANK1=1) for users of the Nkunganire (Government Subsidy) programme and non-users of the programme is not very high. This can be explained by the fact that although the government has tried to expand the programme to all small-scale farmers, only a few them in the study areas benefited from it.

Interestingly, earnings from previous sales of watermelons were found to be the strongest predictor of the watermelon productivity/yield in the study regions. The estimated coefficient (0.882) of the natural logarithm of farm incomes from previous sales of watermelons (log10_PI) is significantly positive and highly statistically significant at the 10% significance level (P (0.000) <0.05) (Table 4). Specifically, a 1% increase in the farm income from the previous sales of watermelons increases the farm productivity of small-scale watermelon farmers in the study areas by about 0.882 units or 88.2%. These results support the argument that fair market prices for watermelons should be an important component of interventions aimed at improving watermelon productivity of small-scale farmers in the study areas.

4.5. Hypothesis test

The main objective of this study was to analyze the effect of access to finance on watermelon productivity of the small-scale farmers in Bugesera and Kayonza districts using linear regression model analysis. More specifically, the study aims to analyze the effect of access to credit on watermelon productivity among small scale farmers in the districts of Bugesera and Kayonza, assess the impact of the Nkunganire (Government Subsidy) programme on watermelon productivity among small scale farmers in Bugesera and Kayonza Districts and finally and evaluate the effect of income from previous sales of watermelons on the watermelon productivity of the last agricultural season. The results on these hypotheses test are presented in the Table 5 below:

Table: 5: Summary of the major findings

| Hypothesis | Regression weights | B | T | P-value | Results |
|-----------------|--------------------|----------|-------|---------|-----------------------------|
| H0 ₁ | ACRDT1- log10_AP | 0.066** | 2.000 | 0.049 | H0 ₁ is rejected |
| H0 ₂ | ANK1- log10_AP | -0.059** | 0.005 | 0.048 | H0 ₂ is rejected |
| H0 ₃ | PI- log10_AP | 0.882*** | 24.78 | 0.000 | H0 ₃ is rejected |
| R ² | 0.871 | | | | |
| F-statistic | 175.112 | | | | |

Source: Primary data, 2022

Where: **, *** indicating that the significance levels at 5% and 10 per cent respectively, ACRDT1 stand for dummy variable for access to credit, ANK1: dummy variable representing the data for those who benefited from Nkunganire (Government Subsidy) program and PI: previous income from sales of water melon, R²:coefficient of determination. The hypotheses have been tested with the help of the P-value. The results led to the rejection of all three Null hypotheses as the p-value were found to be less than the level of significance in all three variables.

5. Conclusion



The findings indicated that the access to credit, access to Nkunganire (Government Subsidy) and use of previous income are statistically significant in explaining the relationship between the study variable as indicated by a P-value of 0.049, 0.048 and 0.000 which are respectively less than 5%.

The study concludes that the access to credit has an effect on agricultural productivity of water melon in Bugesera and Kayonza Districts, Eastern Province and as 1 unit increase of access to credit will cause the increase by 0.066 units or 6.6% of water melon productivity. This led the researchers to reject the Hypothesis that there is no effect of access credit on watermelon productivity among small scale farmers in Bugesera and Kayonza Districts.

There is a base to conclude that the access to Nkunganire (Government Subsidy) has an effect on agricultural product. This is due to that 1 unit increase of access to Nkunganire (Government Subsidy) would cause the increase of watermelon productivity by 0.059 units or 5.9%. This led the researchers to reject the hypothesis that there is no effect of Nkunganire (Government Subsidy) programme on watermelon productivity among small scale farmers in Bugesera and Kayonza Districts.

It is also concluded that the use of income from the previous sale has an effect on agricultural productivity and this was confirmed by the fact that 0.88 units or 88% of water melon productivity results from 1 increase in units use of income from the previous sale. The results lead the researchers to reject the hypothesis that there is no effect of income from previous sales on last watermelon productivity season in Bugesera and Kayonza Districts.

Considering that the water melon productivity is influenced at 86.6% by the access to finance, there is a base to conclude the effect of access to finance on agricultural productivity among the small farmers in Bugesera and Kayonza Districts.

6. Recommendations

The results of this study show that access to credit has a positive and significant impact on agricultural productivity; therefore, access to credit in agricultural sector should be among the priorities of Rwanda Agriculture Board (RAB). Thus, there is a need to improve access to credit at a lower cost through banks and other specialized financial institutions portfolio.

The results show that previous watermelon sales revenue is the strongest predictor of watermelon productivity in the study region; therefore, the market price of watermelons should be reasonable to motivate the small-scale watermelon growers to increase watermelon productivity in the study area.

Although the government has tried to expand the Nkunganire (Government Subsidy) programme to all small-scale farmers, a large number of them (47.7%) is not grasping that opportunity and hence extension services are needed to sensitize these farmers to access the Nkunganire (Government Subsidy) programme in order to increase their productivity.



References

- Adewale, A. T., Lawal, O. A., Aberu, F., & Toriola, A. K. (2022). Effect of Credit to Farmers and Agricultural Productivity in Nigeria. *East Asian Journal of Multidisciplinary Research*, 1(3), 377-388.
- Ali, D. A., Deininger, K., & Duponchel, M. (2014). Credit constraints and agricultural productivity: Evidence from rural Rwanda. *Journal of Development Studies*, 50(5), 649-665.
- Amin, M.E. (2005). *Social Science Research: Conception, Methodology and Analysis*. Makerere University Press, Kampala
- Awunyo-Vitor, D. (2018). *Theoretical and conceptual framework of access to financial services by farmers in emerging economies: Implication for empirical analysis*. *Acta Universitatis Sapientiae, Economics and Business*, 6(1), 43-59.
- Bizoza, A. R., Nkurukiye J. b., & Byishimo P., (2018). *Towards Sustainable Agriculture - An analysis of farmers' participation in agriculture programmes in Rwanda*.
- Bless, C. & Higson-Smith, C. (2000). *Fundamentals of Social Research Methods: An African Perspective*. 3rd Edition. Lusaka: Juta.
- Chisasa, J., & Makina, D. (2012). Trends in credit to smallholder farmers in South Africa. *International Business & Economics Research Journal (IBER)*, 11(7), 771-784.
- Combary, O. S. (2022). *Farm productivity under financial constraints in developing countries: evidence from maize smallholder farmers in Burkina Faso*. *Agricultural and Resource Economics Review*, 1-11.
- Cotei, C., & Farhat, J. B. (2009). *The trade-off theory and the pecking order theory: are they mutually exclusive?*. Available at SSRN 1404576.
- Dixon, J., A. Gulliver, & Gibbon, D. (2001). *Farming Systems and Poverty: Improving Farmers' Livelihoods in a Changing World*. Rome and Washington, DC: FAO and World Bank.
- Frank, M. Z., & Goyal, V. K. (2003). *Testing the pecking order theory of capital structure*. *Journal of financial economics*, 67(2), 217-248.
- Frisvold, G., & Ingram, K. (1995). *Sources of agricultural productivity growth and stagnation in sub-Saharan Africa*. *Agricultural Economics*, 13(1), 51-61.
- Girabi, F., & Mwakaje, A. E. G. (2013). Impact of microfinance on smallholder farm productivity in Tanzania: The case of Iramba district. *Asian Economic and Financial Review*, 3(2), 227-242.
- Hemming, D. J., Chirwa, E. W., Dorward, A., Ruffhead, H. J., Hill, R., Osborn, J., ... & Phillips, D. (2018). *Agricultural input subsidies for improving productivity, farm income, consumer welfare and wider growth in low-and lower-middle-income countries: a systematic review*. *Campbell Systematic Reviews*, 14(1), 1-153.



- Houensou, D. A., Goudjo, G. G., & Senou, M. M. (2021). *Access to finance and difference in family farm productivity in Benin: Evidence from small farms*. *Scientific African*, 13, e00940.
- Jayne, T. S., LOUISE, F., Fuglie, K., & Adelaja, A. (2021). *Agricultural productivity growth, resilience, and economic transformation in sub-Saharan Africa*. Association of Public and Land-grant Universities (APLU).
- King, R. G., & Levine, R. (1993). *Financial intermediation and economic development*. *Capital markets and financial intermediation*, 156-189.
- Langyintuo, A. (2020). *Smallholder farmers' access to inputs and finance in Africa*. In *The Role of Smallholder Farms in Food and Nutrition Security* (pp. 133-152). Springer, Cham.
- Merton, R. C. (1995). *A functional perspective of financial intermediation*. *Financial management*, 23-41.
- Mozumdar, L. (2012). *Agricultural productivity and food security in the developing world*. *Bangladesh Journal of Agricultural Economics*, 35(454-2016-36350), 53-69.
- Owens, L. K. (2002, January). *Introduction to survey research design*. In *SRL fall 2002 seminar (Vol. 1)*.
- Owusu, S. (2017). *Effect of access to credit on agricultural productivity: Evidence from Cassava farmers in the afigya-kwabre district of Ghana*. *International Journal of Innovative Research in Social Sciences & Strategic Management Techniques*, 4(2), 55-67.
- Rahman, S., Hussain, A., & Taqi, M. (2014). *Impact of agricultural credit on agricultural productivity in Pakistan: An empirical analysis*. *International Journal of Advanced Research in Management and Social Sciences*, 3(4), 125-139.
- Sánchez-Vidal, J., & Martín-Ugedo, J. F. (2005). *Financing preferences of Spanish firms: Evidence on the pecking order theory*. *Review of Quantitative Finance and Accounting*, 25(4), 341-355.
- Sekyi, S., Domanban, P. B., & Honya, G. K. (2019). *The impact of informal credit on rural agricultural productivity in the savannah ecological zone of Ghana*. *African Journal of Economic and Management Studies*.
- Seven, U., & Tumen, S. (2020). *Agricultural credits and agricultural productivity: Cross-country evidence*. *The Singapore Economic Review*, 65(supp01), 161-183.
- Sinha, T. A. P. E. N. (2001). *The role of financial intermediation in economic growth: Schumpeter revisited*. *Economic Theory in the light of Schumpeter's Scientific Heritage*, India: Spellbound Publishers.
- Taremwa, N. K., Macharia, I., Bett, E., & Majiwa, E. (2021). *Impact of agricultural credit access on agricultural productivity among maize and rice smallholder farmers in Rwanda*. *Journal of Agribusiness and Rural Development*, 59(1), 39-58.



Thirtle, C., Lin, L., & Piesse, J. (2003). *The impact of research-led agricultural productivity growth on poverty reduction in Africa, Asia and Latin America*. *World Development*, 31(12), 1959-1975.

Wiggins, S. (2009). *Can the smallholder model deliver poverty reduction and food security for a rapidly growing population in Africa?* Paper for the Expert Meeting on How to feed the World in 2050, Rome.

Zuberu, E., Ari, M. A., & Iliya, B. (2019). Effect of agriculture financing on agriculture productivity in Nigeria. *International Journal for Innovative Research in Multidisciplinary Field*, 5(7), 104-15.