INTERNATIONAL JOURNAL OF
SCIENCE ARTS AND COMMERCE

Effect of Semi Formal Financial Institutions Credit to Maize Productivity in Sumbawanga Rural and Mbozi Districts in Tanzania

Dionis Joseph Ndolage[1]; Gwahula Raphael, PhD[2] and Saganga Kapaya, PhD[3]
The Open University of Tanzania, Faculty of Business Management, Dar es Salaam, Tanzania.

Abstract
This study aimed at examining the effect of semi formal financial institutions credit to maize productivity of rural smallholder farmers in Sumbawanga rural and Mbozi districts in Tanzania. The study was guided by the theory of financial intermediation and neoclassical economic growth theory. The research design was descriptive quantitative in nature where balanced panel data for the year 2018 to 2020 was used. Random effect model was used to analyze 321 sample observations of the collected secondary data which involved 107 individuals. The results indicated that semi formal financial institutions credit has significant and positive effect on maize productivity. It was also revealed that semi formal financial institutions credit has significant and positive association with maize productivity. The study concludes that semi formal financial institutions credit is predictor of maize productivity to rural smallholder farmers in Tanzania. Thus, it is recommended that policy makers (government) should set policies that encourage the increase of financial access points, reduced transaction costs and enrolling agricultural trustworthy agents in rural areas.

Keywords: Informal credit, smallholder farmers and maize productivity.

1. Study Background
The emphasis and awareness of maize productivity on rural societies is a growing global concern. World maize production is about 10.14 billion metric tons and the United States of America (USA) is the largest producer, producing over 30 % followed by China 21 % and Brazil 7.9 % while Africa produces around 7 % of the total world maize production, (Rashid, 2015). Two-thirds of all Africa maize comes from eastern and southern Africa. In Tanzania, most societies consume maize as their staple food and the need for maize productivity has increased

globally on which its importance has increased an interest in the research on the factors that affect it. Maize agriculture occupies about 45% of the total land of Tanzania and about 4.5 million of rural smallholder farmers utilize their land for this crop. Maize is highly grown in Mbozi district with 67,736 ha followed by Sumbawanga covering 65,434ha in Southern highland part of Tanzania (NBS, 2007 Report from 2002/2003 agricultural sensor). Its production contributes about 31 % of the total food production and constitutes more than 75 % of the cereal consumption in Tanzania, (Olaniyi *et al,* 2012 and Verheye, 2010). Rural smallholder farmers contributing 85% of total national production, the rest being contributed by community farms, large farms both private and public, (Miho, 2017 and Lwesya, 2017).
Ogunleye,(2018) posited that, semi formal financial institutions credit financing has been the centerpiece of many rural development programs in developing countries. The need for semi formal financial institutions credit is more demanded and applicable in the rural areas This need is for acquiring improved inputs like advanced technology, fertilizers, modern seed, pesticide, insecticide, plant protections and so on, (Yusuph et al., 2014). Miho, (2018) argued that to meet the required essential agricultural inputs to bring about the increased maize productivity, borrowing becomes inevitable. However, little effort by most government in the developing countries have been done to support rural smallholder farmer on how to utilize semi formal financial institutions credit given the largest population who are engaged into the agricultural sector(Awotide, 2015).

In addition to that, efforts to mobilize domestic savings and provision of credit disbursement among individuals have for too long been concentrated in the urban areas because rural smallholder farmers are thought to be too poor to save or riskier to receive credit from most formal sources, (Chandio et al., 2016). Nevertheless, the effect of less credit in financing agriculture has reduced maize productivity of most farmers in rural areas in most of the developing countries, (Ogunleye, 2018). Moreover, despite several efforts that has been made by most governments in Africa and in most developing countries, over fifty percent of the population that is engaged as smallholder maize farmer continues to have lower maize productivity (NBS, 2015).

On the same vein, agricultural sector in developing countries such as the united republic of Tanzania (U.R.T) continues to exhibit low maize productivity in comparison with developed countries like United States of America and China, (Undry, 2015). For instance, in the year 2014 maize productivity of the united republic of Tanzania was about 1.3 ton per hectare. The productivity that was low when compared to other countries like South Africa that had 2.7 ton per hectare and the World whose maize productivity was at 4.3 tons per hectare (NBS, 2015). Thus, due to the increasing needs for semi formal financial institutions credit to facilitate maize productivity worldwide, the analysis of the effect of semi formal financial institutions credit on maize productivity is the consequential issue to Tanzanian rural agriculture stakeholders, (Rashid, 2015). In the other word, there was a need to conduct this study in Tanzania context so

that to contribute in the literature for the effect of semi formal financial institutions credit on maize productivity in rural areas.

2. Literature Review

2.1 Theoretical Grounding

In this part, the theoretical review reflects among the relationship between the real world practices and current theory of financial intermediation. Critical analysis of this current theory of financial intermediation expected to leads to several building blocks of a new financial intermediation theory (FIT). Therefore, in this study financial intermediation theory literature reviews was used to provide an explanation on why these financial intermediaries exist then the link between semi formal financial institutions credit and maize productivity was established. In addition to that, this study uses neoclassic economic growth theory (NEGT) in explaining the concept of maize productivity. The current neoclassical economic growth theory (NEGT) provided an economic model of growth that outlines how steady economic growth rate results when capital, labour and technology come into play, Masoud, (2013). He also posited that with neoclassical economic growth theory, capital and labour are received as income input variables that contribute to agricultural productivity. He further argued that, its theoretical construction is based on the national aggregates of capital and labour, on which the contribution of capital and labour in the national aggregate, are simply the amount of contribution of each factor of production received in the aggregate. Therefore, this study considered that, it is necessary to provide capital injection from relevant variation sources in a more comprehensive approach. Hence, the introduced semi formal financial institutions credit variable accommodated a source of capital in neoclassical economic growth theory (NEGT).

Furthermore, the concept of financial intermediation theory was brought up, starting in the mid twenty-th century in the 1960's about sixty years ago by the work of Guley and Shaw, (1960). The starting work of (Gurley and Shaw, 1960) on financial intermediation theory (FIT) was based on the agency theory and the theory of informational asymmetry. In addition to that, the financial development nexus was an established source(s) of debate among economists since Patric (1996)'s seminal work that established his first hypothesis. He hypothesized on a bi direction relationship among financial development and countries economic growth. Several empirical literatures have tested this hypothesis, (Methew and Thompson, 2005). With regard to (Gertler and Kiyotaki, 2011) financial intermediation can accelerate economic growth by influence rate of saving and the marginal productivity of investment(s). He further argued that the role of financial intermediaries lies in the views of financial intermediation and consider its major role as to transfer financial resources from savers in an economy to investor(s).

Additionally, Werner, (2016) argued that, apart from banks, any other semi formal financial institutions can also make loans and assess the loan applicant's credit worthiness and be able to monitor their performance. He also posited that improving the efficiency of semi formal financial institutions sectors like microfinance institutions (MFIs), village community bank (VICOBA),

saving and credit cooperative societies (SACCOS) and non government organizations (NGOs) may lead into agricultural productivity same as the banks. Based on this view, this study proposed hypotheses that includes semi formal financial institutions sector as the financial intermediaries that create short-term debts and deposit to fund loans. This study has also considered maize productivity of rural smallholder farmers in Tanzania context. The proposed hypothesis stated that;

H0: Semi formal financial institutions credit has a positive and significant effect on maize productivity among rural smallholder farmers.

2.2 Empirical Grounding and Hypothesis Formulation

Effect of Semi Formal Financial Institutions Credit on Maize Productivity of Rural Smallholder Farmers.

The critical review of semi formal financial institutions credit and maize productivity constructs indicates that, there are scanty literatures especially in the developing countries. Majority of the literatures so far are mainly concentrated in developed countries, (Adjognon et al., 2017). Therefore, in this sub section, the current study focuses on the effect semi formal financial institutions credit to maize productivity to rural smallholder maize farmers in Tanzania context. The mentioned semi formal financial institutions credit includes the credit receive by individual maize farmers from either government or non government organization (NGO's), microfinance institutions (MFI's), saving and credit cooperative societies (SACCOS) or village community bank (VICOBA). Some global authors who identified the relationship between semi formal financial institutions credit and maize productivity to rural smallholder maize farmers include (Bora et al., 2019; and Kajenthini and Thayaparan, 2017). Others authors in Africa and East Africa includes that of (Ohen et al., 2018; Nuhu et al,. 2014; Geta et al., 2014; Agunleye, 2018 and Ekise et al., 2013).

The study by Kajenthini and Thayaparan, (2017) examined the impact microfinance loans to paddy productivity among rural smallholder farmers in Sri Lanka. The aim of this study was to analyze the impact of micro-finance loans on paddy production among smallholder farmers and to identify the differences in paddy production who were borrower and non borrower of microfinance loans from micro-finance institutions in Sri Lanka. The researcher used primary data that were gathered using modified version of structured questionnaires and applied a random sampling techniques to collect a sample of 93 paddy farmers who were credit beneficiaries and non-credit beneficiaries from the study area. Additionally, the analysis of the collected data was done by simple regression model using dummy variables The study results of the sample t-test revealed that there was an increase on average production among the micro-finance credit beneficiaries as compared to non- the micro-finance credit beneficiaries. The current study is different from this study because the authors improved the methodology by employing panel data with 321 sample observations.

Another study by Borah et al., (2019) from India, investigated the impact of non government organizations (NGOs) agricultural development in India. The aim of this study was to evaluate

the impact of accessed agricultural credit by smallholder farmers who are non government organization (NGO's) members to agricultural yields per acre. They collected primary data that was analyzed by simple regression model. The study results of the sample t-test revealed that, after non government organizations (NGOs) interventions there happened an increase in agricultural productivity and household farmers. The current study improved the methodology of this study by employing random effect model of analysis on the panel data with 321 sample observations.

Moreover, Ogunleye, (2018) examined the effects of access to microcredit on agricultural productivity of rural smallholder farmers in Nigeria. The aim of this study was to investigate the productivity and profitability differential among cassava smallholder farmers who had access to microcredit from microfinance institutions and those who did not have access to microcredit form microfinance institutions (MFIs). The study results revealed that majority of the respondents were male and cassava productivity were very high to cassava farmers with access to micro credit from micro finance institutions compared to those without access to microcredit. T he current study improved the methodology for this study by employing panel data with 321 sample observations use the random effect model to analyze the data. The study by Anang et al.,(2016) examined the effects of agricultural credit on rice productivity for small house hold farmer's credit beneficiaries as compared to small house hold farmers non-credit beneficiaries in Ghana. The aim of this study was to compare the rice productivity for the smallholder farmer's who credit beneficiaries were and those who were non credit beneficiaries. The collected data was analyzed using Cobb-Doglas production model. The study results revealed that, rice productivity increased to respondents who used credit. It was also revealed that there was an insignificancy effect of credit on technical efficiency to rice productivity for credit participants with small loan size. Hence the authors suggested that microfinance institutions must lender enough credit to right farmers who have need for it so that to minimize the possibility of channellining received credit into other uses. The current study also improved the methodology by employing three years panel data and the random effect model to analyze the data.

Additionally, the study by Gater et al, (2017) investigated the access of microcredit and its effects on crop productivity and household income in Ethiopia. The aim of this study was to identify the factors that affect access to credit from microfinance institutions and evaluating its effect on maize and haricot beans productivity and small house hold farmer's income. The results from all methods of analysis showed that access to microcredit from microfinance institutions is significant and had positive effects on maize productivity in rural areas. The current study improved this study by improving the methodology and employing three years panel data with 107 individual samples that is 321 sample observations.

Similarly, the study by Mwakaje et al, (2013) investigated the impact if microfinance institutions credit to maize and sunflowers productivity of smallholder farmers in Tanzania. The aim of this study was to investigate the impact of microfinance institutions to maize and sunflower productivity on smallholder farmers of Iramba district in Tanzania. The study results of the

sample t-test revealed that there was an increase in aggregate productivity and individual crop productivity among the micro-finance credit beneficiaries as compared to non- the micro-finance credit beneficiaries. The current study improved the methodology by employing random effect model for data analysis using panel regression analysis with Stata 13 software. Despite these revealed results of the empirical literature review above, this study seconded the null hypothesis stated in section 2.1 above.

2.3 Conceptual Framework

The model suggests that maize productivity may be improved using semi formal financial institutions credit as suggested in the contribution made to the theory of financial intermediation by authors such as Werner, (2016). The diagram stipulates that semi formal financial institutions credit increases maize productivity. Moreover, the study considered age, gender, fertilizers, pesticide, insecticide, households size, education, experience, maize type, infrastructure, irrigation, and levels of mechanization as the dummy or control variables. Hence, all the dummy variable have not been shown in the conceptual frame work lather they have been kept constant on this study because they are not the primary concerned on the study outcome (Linh, 2019; Chandio et al., 2018 and Mustapha, 2017).The following conceptual model (figure 2.1) shows the connection between semi formal financial institutions credit and maize productivity investigated in this study.

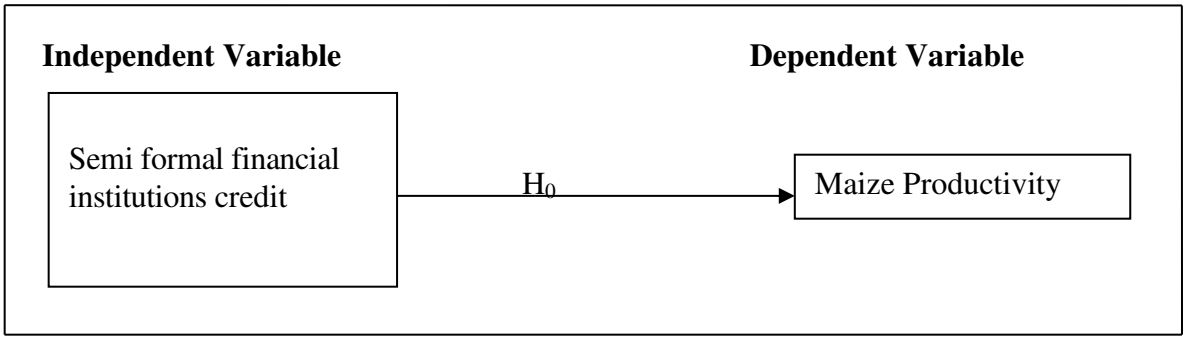

Figure 2.1 Conceptual framework of the study

Source; Developed from theoretical literature review (2020)

3. Materials and Methods

3.1 Targeted Population and Area of the Study

The population of interest for this study was 987,132 rural smallholder maize farmers in Mbozi districts in Songwe region and Sumbawanga rural district in Rukwa region in the southern highland zone of Tanzania. This population was from 507,124 smallholder maize farmers of Mbozi district and 480,008 smallholder maize farmers in Sumbawanga rural district. Southern highland zone was chosen because is the highest maize grower zone in Tanzania, consisting of

Mbeya, Iringa, Songwe, Njombe, Ruvuma and Rukwa regions producing about 42% of the total maize produced in Tanzania, (NBS, 2015). In addition to that, according to (NBS, 2012 agriculture census report in Tanzania), Mbozi district lead in maize productivity with 67,736 hectares followed by Sumbawanga rural district with 65,434 hectares. Moreover, Mbozi district is bordered to the north by Chunya district, to the east by Mbeya urban and Ileje district, to the south by Zambia and to the west by Rukwa region while Sumbawanga rural district is one of the three districts of Rukwa region, bordered to the northeast by Sumbawanga Urban District, to the south by Zambia and to the northwest by the Nkasi district of Katavi region.

3.2 Sampling Procedure and Design

The selection of a sample from the population is commonly used because of the resource limitation to cover the whole population (Sunder et al., 2012). In this research study, the probability sampling technique was used, including multistage and random sampling to get representative sample in order to allow generalization of the findings. Multistage cluster sampling was used at three stages to get the study sample. The first stage was guided by District Agricultural and Livestock Development Officer (DALDO) in Mbozi and Sumbawanga rural districts. At this stage secondary data were obtained from district agricultural loan record book from the two districts. This was done to select wards with largely located maize farmer who are credit beneficiaries. In the second stage, based on the same assumption mentioned above, secondary data for each village were obtained from wards agriculture record book (WARB). Finally, the secondary data of each individual for the maize productivity and semi formal financial institutions credit from the selected villages were listed in the checklist.

3.3 Data Collection (Sources)

This study employed panel data where secondary data was used. The secondary data for both maize productivity and semi formal financial institutions credit were collected from wards agriculture record book (WARB) for the year 2018, 2019 and 2020. A check list was also used. This ensured that individual's important information was not overlooked. Some individual farmer's missing information in the WARB were such as land preparation cost, planting cost, weeding cost, Harvesting cost, maize cleaning cost, cost of transportation of maize harvest from farm to home, plough cost and tractor cost. In addition to that, a check list with individual required information for the study and a copy of wards agriculture record book (WARD) was distributed with the help of research assistant. Sampled individuals were asked to fulfill all credit facilities and maize production information as recorded into wards agriculture record book (WARD) with help of research assistant for the three consecutive maize seasons (i.e. year 2018, year 2019 and year 2020).

3.4 Measurement Variables of the Study

Semi formal financial institutions credit variable were measured from their ratios. These ratios were obtained by taking the total individual semi formal financial institutions credit borrowed by

a farmer in a particular season over total money used by a farmer per acre. Table 3.1 stipulates the year (season) of maize production, semi formal financial institutions credit rendered to farmer in that year (season), the individual semi formal financial institutions credit that rendered credit, individual credit (Tzsh) from the particular individual source and total individual credit (Tzs) received by individuals.

Table 3.1 Measurement of Informal Credit

Years (Season)	Independent variable	Lender (s)/Institution (s)	Individual Credit received (Tzs)	Total individual Credit Received (Tzs)
	semi formal financial institutions credit	Non government organizations (NGOs)		
		Microfinance institutions (MFIs)		
		Village community bank (VICOBA)		
		Saving and credit cooperative societies (SACCOS)		

Source: Chandio et al., (2018) and Aphu *et al.,* (2017)

Moreover, maize productivity measurements were from the ratios of total maize produced (output) in grams per acre over total money (capital injected) used (input) in Tanzanian shillings (Tzs). The output was the total grammes of maize produced in a particular season per acre while the input was the amount of money used in that season per acre. Table 3.2 stipulates the year (season), identification for the money used or not used on an individual item, the total money used to all individual items and total maize produced (output) in grams per acre.

Table 3.2 Measurement of Maize Productivity

Year (season)	Item description	Used (Please tick (√))	Not used (Please tick (√))	Total Money used (capital injected) -Tzs	Total maize produced (output) - gm/ acre
2018 or 2019 or 2020	Land hire				
	Land Preparation				
	Labour hired				
	Hoes				
	Plough				
	Tractor				
	Seeds				

	Planting				
	Weeding				
	Fertilizer				
	Pesticide				
	Insecticide				
	Harvesting				
	Cleaning				
	Transportation of harvest (home, godown etc.)				

Source: Chandio *et al.,* (2018) and Aphu *et al.,*(2017)

3.5 Data analysis

In this study, before the actual data analysis, collected data was virtually inspected to check for incompleteness, data entry errors and data which are missing. This was done to ensure that data was of good quality. Therefore, the quantitative data for all three research objectives were tabulated and analyzed by the relevant statistical tool. The study employed panel data regression with the help of Stata 13 software. Both descriptive and inferential data analysis were employed in data analysis.

3.6 Hypothesis Testing

Equations to test the effect of semi formal financial institutions credit to maize productivity have been expressed as a simple regression. The purpose of this regression equation for this research was to predict maize productivity variable as a linear function of semi formal financial institutions credit injected and the control variables. Therefore, maize productivity was explained as a function of semi formal financial institutions credit together with the control (dummy) variables.
Thus, written as;

$$Maize.\Pr oductivity = f(Semi.formal.financial.institutions.Credit + Control.Variables)$$

Moreover, the other reason for use of regression equation were to determine whether informal explains a significant variation in maize productivity, determine how much of the variation in the maize productivity variable can be explained by informal credit and to control for the identified control variables.

3.7. Model Specification

Random effects models (REM) for panel data were used to estimate the data. Random effects models (REM) assumes that the individual-specific effect is a random variable that is uncorrelated with the explanatory variables. However, during the choice of the best model to use for this study, the fixed effect model (FEM) was estimated by using *xtreg* and least square dummy variable (LSDV). Moreover, the random effect model (FEM) was also estimated by *xtreg* with *re*. Thus, to decide between REM and FEM, both models were run and then Hausman

test was performed, where random effects models (REM) had most reliable results and is the model that fitted the collected data most correctly.

4.0 Study Results

4.1 Results from Multicollinearity Testing

The multiple linear regression models were run and Stata 13 command tool used to check for multicollinearity was *vif* and the results are shown in table 4.1. Hair *et al.,* (2010) argued that correlation analysis and variance inflation factor (VIF) can be used to check for multicollinearity. However, Kline, (2011) posits that correlation analysis do not exactly measure the degree to which each of the independent variable is explained by the set of other independent variables and therefore opting variance inflation factor (VIF). In this study the variance inflation factor (VIF) was used to test multicollinearity.

Table 4.1 below indicates that the VIF for semi formal financial institutions credit ratio is 1.407. The Tolerant values (1/VIF) for semi formal financial institutions credit ratio is 0.711. Moreover, all variables had VIF less than 5 and Tolerant values (1/VIF) are more than 0.2. The authors posit that the VIF values greater than 5 and Tolerant values less than 0.2 indicates the presence of multicollinearity. Therefore, multicollinearity results in table 4.1 indicates that there was no multicollinearity issue in the current study as the Tolerant and VIF values did not exceed the threshold values.

Table 4.1 Multicollinearity Test Results Using VIF Test

Variables	VIF	1/VIF
Semi_ ratio	1.407	.711
educ levels	1.720	.581
Insecticide	2.646	.378
Pesticide	2.638	.379
Fertilizer	2.571	.389
Modernseed	2.309	.433
Farmsizes	1.426	.701
house size	1.372	.729
Experiences	1.223	.818
Mean VIF	1.910	.

Source: Data analysis (2020)

4.2 Regression results for Independent Variable Determinants.

The independent variable for this study was semi formal financial institutions credit. This was measured from individual semi formal financial institutions credit ratio. This ratio was obtained by taking the total individual semi formal financial institutions credit borrowed in a particular season over total money used (capital injected) by a farmer per acre.

The result from table 4.2 shows that, semi formal financial institutions credit ratio (semi_ratio) variable results improving from 1.75*** in random effect model (REM) 6 and 7 to 1.84*** in

random effect model (REM) 1, 2 and 8. These ratio results indicate that, semi formal financial institutions credit is significant to maize productivity. Also the results show that, a unit increase of semi formal financial institutions credit ratio increases maize productivity of the individual farmer up to 1.84 units.

Moreover, The within r square results from table 4.2 indicates that, model 7 and model 8 performed better as compared to model 1, model 2, model 3, model 4, model 5 and model 6. This is as well supported by a higher explanatory power for r2 on model 7 and model 8. However, the between r square results indicates model 3 performed better as compared the other model. It also shows that, the overall r square result for model 3 performed better as compared the other model.

Additionally, the results from table 4.2 indicates that, the within r square results for model 1 to model 6 is 0.14. The within r square results for model 7 and model 8 is 0.17. These within r square results indicates that, model 7 and model 8 performed better as compared to model 1, model 2, model 3, model 4, model 5 and model 6. This is as well supported by their higher explanatory power, because r2 for model 7 and model 8 are higher than for that of model 1, model 2, model 3, model 4, model 5 and model 6. Therefore, these results indicate that 17% of the variance of dependent variable (maize productivity) was explained within individuals over time.

Additionally, the between r square results 0.25 for model 3. In this group, the between r square results indicates that, model 3 performed better as compared to other models. The model 3 results, also indicates that 25% of the variance of dependent variable (maize productivity) were explained between individual independent variables (i.e informal credit) over time. Likely, the overall r square results for model 3 is 0.26. These overall r square results indicates that, model 3 performed better as compared to other models. Model 3 results, also indicates that, 26% of the variance of dependent variable (maize productivity) are explained by the independent variables over time. The overall r square variances are based on 321 sample observations.

Furthermore, table 4.2 shows the root mean square error (rmse) result of model 1 to model 7 equals to 1.12 and 1.15 for model 8. These rmse results are all close to zero which indicates that the model fit much better to the collected data. Similarly, table 4.2 indicates the chi2-tests results of 69.00 for model 8. These results indicate that, model 8 was much better than other models. This is because; the higher the results of the chi2 value indicate the model fit much better to the collected data, (Park, 2011).

Table 4.2: Regression results

	(1) REM	(2) REM	(3) REM	(4) REM	(5) REM	(6) REM	(7) REM	(8) REM
semi_ratio	1.84***	1.84***	1.86***	1.80***	1.80***	1.75***	1.75***	1.84***
	(0.25)	(0.25)	(0.25)	(0.25)	(0.25)	(0.25)	(0.25)	(0.26)
_cons	5.62***	5.35***	5.52***	1.80	3.36	4.66***	5.30**	4.27
	(0.71)	(0.92)	(0.68)	(2.42)	(2.53)	(1.51)	(2.48)	(3.72)
Obs.	321	321	321	321	321	321	321	321
r2_w	0.14	0.14	0.14	0.14	0.14	0.14	0.17	0.17
r2_b	0.16	0.16	0.25	0.16	0.16	0.17	0.19	0.24
r2_o	0.17	0.17	0.26	0.16	0.16	0.16	0.19	0.22

rmse	1.12	1.12	1.12	1.12	1.12	1.12	1.15	1.15
chi2	54.39	54.39	.	54.23	54.23	55.34	62.66	69.00

Standard errors are in parenthesis
*** p<0.01, ** p<0.05, * p<0.1

4.3 Regression Results for Dependent Variable Determinants

Maize productivity measurements were from the ratios of total maize produced (output) in grams per acre over total money (capital injected) used (input) in Tanzanian shillings (Tzs). The output was the total grammes of maize produced in a particular season per acre while the input was the amount of money used (injected) in that season per acre. Table 4.3 indicates the panel regression results for the eight models which explain the dependent variable determinants. The results indicates that, costs for land preparation, plough, tractor, seed, weeding, harvest, cleaning and transport are not significant to maize productivity. The results for model 8 indicates that, a unit increase of these cost increases maize productivity by 0.32, 0.13, 0.22, 0.04, 0.13, 0.46, 0.15 and 0.23 units respectively.

Table 4.3 Regression results

	(1) REM	(2) REM	(3) REM	(4) REM	(5) REM	(6) REM	(7) REM	(8) REM
semi_ratio	1.84***	1.84***	1.86***	1.80***	1.80***	1.75***	1.75***	1.84***
	(0.25)	(0.25)	(0.25)	(0.25)	(0.25)	(0.25)	(0.25)	(0.26)
landprepcosts							0.31	0.32
							(0.34)	(0.34)
ploughcosts							0.02	0.13
							(0.25)	(0.25)
tractorcosts							0.12	0.22
							(0.72)	(0.76)
seedcosts							0.08	0.04
							(0.40)	(0.41)
weedingcosts							0.14	0.13
							(0.45)	(0.45)
harvestcosts							0.46	0.46
							(0.38)	(0.38)
cleaningcosts							0.15	0.15
							(0.31)	(0.31)
transpcosts							0.18	0.23
							(0.37)	(0.37)

Standard errors are in parenthesis
*** p<0.01, ** p<0.05, * p<0.1

4.4 Group of Control Variable Regression Results

The control variables used in this study are age, education level, farm size, seed type, pesticide, insecticide, household size and experience. Group separation of ordinal variables and categorical variables during regression was done so as to avoid multicolinearity. The statistics results in table 4.4 indicate that, age, education level, household size, experience and farm size was

statistically not significant to maize productivity. The results also implies that, a unit increase in the use of modern seed, pesticide, insecticide and fertilizer by individuals increases maize productivity by 0.53,0.03,0.25 and 0.15 respectively. Additionally, farming experience and farm size has a negative association to maize productivity by individuals.

Table 4.4 : Regression results

	(1) REM	(2) REM	(3) REM	(4) REM	(5) REM	(6) REM	(7) REM	(8) REM
semi_ratio	1.84***	1.84***	1.86***	1.80***	1.80***	1.75***	1.75***	1.84***
	(0.25)	(0.25)	(0.25)	(0.25)	(0.25)	(0.25)	(0.25)	(0.26)
ages						0.23		0.16
						(0.20)		(0.21)
educ_levels						0.14		0.11
						(0.22)		(0.24)
house_size						0.18		0.14
						(0.24)		(0.25)
experiences						-0.23		-0.26*
						(0.16)		(0.16)
farmsizes						-0.16		-0.33
						(0.45)		(0.46)
modernseed							0.37	0.53
							(0.44)	(0.45)
perticicide							0.03	0.00
							(0.30)	(0.30)
insecticide							0.25	0.24
							(0.36)	(0.36)
fertilizer							0.14	0.15
							(0.46)	(0.46)
_cons	5.62***	5.35***	5.52***	1.80	3.36	4.66***	5.30**	4.27
	(0.71)	(0.92)	(0.68)	(2.42)	(2.53)	(1.51)	(2.48)	(3.72)

Standard errors are in parenthesis
*** $p<0.01$, ** $p<0.05$, * $p<0.1$

4.5. Pair wise Correlation Analysis Results

This study employed Pearson correlation coefficient. Pearson correlation coefficient is the test statistics that measures the statistical relationship, or association, between two continuous variables, Creswell, (2014). Therefore, pair wise correlation analysis was employed so that to determine the relationship between variables without inferring cause and effect of those variables. Table 4.5 shows that, the correlation results for semiformal financial institutions credit ratio (smi_ratio) to maize productivity (Pro_vity) is +0.298*. This correlation results indicates that, semiformal financial institutions credit is significant to maize productivity. It also implies that, there is medium correlation among semiformal financial institutions credit and maize productivity.

Likely, the correlation results of the use of modern maize seed to the use of pesticide, insecticide, fertilizer, hand hoe, plough and tractor are +0.418*, +0.535*, +0.523*, +0.07, +0.048 and +

0.096 respectively. This correlation results indicates that, the correlation of using modern maize seed to the use of pesticide, insecticide and fertilizer are all significant and the correlation of using modern maize seed to the use of hand hoe, plough and tractor are all not significant to maize productivity. It also indicates that, there is small correlation on the use of modern maize seed to the use of pesticide, insecticide, fertilizer, hand hoe, plough and tractor.

On the other hand, the correlation results of the use of pesticides to the use of insecticide, fertilizer, hand hoe, plough and tractor are +0.598*, +0.208*, +0.111*, -0.003, and + 0.073 respectively. This correlation results indicates that, the correlation of using pesticide to the use insecticide, fertilizer and hand hoe are all significant and the correlation of using pesticides to the use of plough and tractor are not significant. It also indicates that, there is small correlation on the use of pesticide to the use of fertilizer, hand hoe, plough and tractor. It further indicates that, the correlation of using pesticide to the use plough has an inverse relationship. It also shows that, a strong correlation on the use of pesticide to the use insecticide.

Moreover, the correlation results of the use of insecticide to the use of fertilizer, hand hoe, plough and tractor are +0.399*, +0.06, +0.018, and + 0.127 respectively. This correlation results indicates that, the correlation of using insecticide to the use of fertilizer is significant and the correlation of using insecticide to the use of hand hoe, plough and tractor are not significant. It also indicates that, there is a medium correlation on the use of insecticide to the use of fertilizer. In addition to that, the results indicate that, there is small correlation of using insecticide to the use hand hoe, plough and tractor.

Furthermore, the correlation results of the use of fertilizer to the use of hand hoe, plough and tractor are +0.009, -0.099 and +0.078 respectively. This correlation results indicate that, the correlation of using fertilizer to the use of hand hoe, plough and tractor is not significant and the correlation of using fertilize to the use plough has an inverse relationship. It also indicates that, there is a small correlation on the use of fertilizer to the use of hand hoe, plough and tractor. Additionally, the correlation results of the use of hand hoe to the use of plough and tractor are +0.068, and -0.315* respectively. This correlation results indicate that, the correlation of using hand hoe to the use of plough is not significant but to the use of tractor is significant. It also indicates that, the correlation of using hand hoe to the use tractor has an inverse relationship. Furthermore, it indicates that, there is a small correlation on the use of hand hoe to the use plough and tractor. Lastly, the correlation results on the use of plough to the use of tractor are -0.349*. This correlation results indicate that, the correlation of using plough to the use of tractor is significant. It also indicates that, the correlation of using plough to the use tractor has an inverse relationship. It also indicates that, there is a medium correlation on the use of plough to the use tractor.

Table 4.5 Correlations Matrix Results

Variables	-1	-2	-3	-4	-5	-6	-7	-8	-9
(1) Pro_vity	1								
(2) semi_ratio	0.298*	1							
	(0)								
(3) modernseed	-0.014	0.112*	1						
	(0.806)	(0.046)							
(4) perticicide	0.072	-0.059	0.418*	1					
	(0.202)	(0.297)	(0)						
(5) insecticide	0.028	0.081	0.535*	0.598*	1				
	(0.622)	(0.151)	(0)	(0)					
(6) fertilizer	0	0.196*	0.523*	0.208*	0.399*	1			
	(0.998)	(0)	(0)	(0)	(0)				
(7) handhoes	0.053	0.028	0.07	0.111*	0.06	0.009	1		
	(0.346)	(0.624)	(0.216)	(0.049)	(0.288)	(0.866)			
(8) ploughs	-0.063	-0.095	0.048	-0.003	0.018	-0.099	0.068	1	
	(0.263)	(0.092)	(0.391)	(0.959)	(0.752)	(0.077)	(0.23)		
(9) tractors	-0.016	-0.077	0.096	0.073	0.127*	0.078	-0.315*	-0.349*	1
	(0.779)	(0.171)	(0.088)	(0.193)	(0.023)	(0.166)	(0)	(0)	

Source: Data analysis (2020)

5. Discussion of the Research Findings

The study aimed at determining the effect of semiformal financial institutions credit on maize productivity of smallholder farmers in Sumbawanga rural and Mbozi districts in Tanzania. Findings revealed that, an increase in semiformal financial institutions credit ratio increased maize productivity of rural smallholder farmers. These findings are consistent with that (Anigbogu *et al.,* 2015) whose findings revealed that agricultural credit is significant and has a positive relationship to agricultural productivity. These results also indicate that, majority of respondents used semiformal financial institutions credit and there was higher dispersion (i.e the extent to which a distribution is stretched (spread) or squeezed) to respondents who used semiformal financial institutions credit. These findings are consistent with that (Duniya and Adinah, 2015 and Chiu *et al.,* 2014) whose findings revealed that agricultural credit is significant and has a positive effect on agricultural productivity to rural smallholder farmers.

Moreover, findings from the correlation matrix on table 4.5 revealed the semiformal financial institutions credit ratio of 0.298*to maize productivity. This result implies that semiformal financial institutions credit is positive and significant to maize productivity. This result also

indicates that, a unit of Tzs increase of semiformal financial institutions credit ratio increases 0.298 units of maize productivity of individuals. These findings are in line with that of (Babajide, 2012) whose findings revealed that agricultural credit is significant and have positive effect to agricultural productivity.

6. Conclusion and Recommendations

The study has confirmed that semiformal financial institutions credit is significant and has a positive effect on maize productivity. It was also confirmed that semiformal financial institutions credit has a positive association with maize productivity. Hence, we concluded that semiformal financial institutions credit is predictors of maize productivity to rural smallholder farmers in Tanzania.

It is therefore recommended that, the policy to be reviewed to improvise farmers to access semiformal financial institutions credit and other capacity building strategies which will influence more participation in the sector. This study also recommends that, the government should set policies that encourage the increase of semiformal financial institutions credit financial access points in rural and remote areas, reduced transaction costs, user friendly regulations to semiformal financial institutions credit lenders, ensuring safety of money lenders, input availability to farmers and stability as well as enrolling agricultural trustworthy agents in rural areas.

7. Areas for Future Research

This study recommends that future studies may include other regions from other zones of the country to gather more information on the effect of semiformal financial institutions credit in the country at large and look into what transpires in the community farms, large farms both private and public.

8. References

Ademola, A. A., Hossein, A & Louise, M. (2017). The era of sustainable agricultural development in Africa: 'Understanding the Benefits and Constraints', Food Reviews: *International journal of agriculture.* Vol.7. NO. 8, pp 63-87.

Adjognon, S.G., Saweda, L., Tasie, L.O., and Reardon, T. A. (2017). Agricultural input credit in Subsaharan Africa: Telling myth from facts. *A journal homepage for food policy.* Vol. 67. Pp 93- 105.

Agunleye, (2018). The effect of access of microcredit on productivity and profitability of cassava farming in Osuna state , Nigeria. *The Agro-Science Journal of Tropical Agricultuture*, Food, Environmental and Extension. Vol.17. NO. 2, pp 51-57.

Amurtiya M; Yuniyus D. G; Mark P, Zubairu E. A (2018); Analysis of rural farm household's access to formal agricultural credit, Adamawa state, Nigeria. *Internal Journal of agriculture and economics.* Vol. 66.No.40, pp 947 – 954.

Anang, B. T., Backman, S., and Sipilainen, T. (2016). The Effect of Microcredit on Smallholder Farmers On Rice Agricultural Productivity in Ghana. *Journal of Agriculture & Rural Development in Tropics and Subtropics Vol. 117 No. 2 (2016) pp 189–202*

Anigbogu, T. U; Onugu, C. U; Igboka, G. E and Okoli, M. I. (2015). Factors affecting cooperative farmers access to agricultural credit from microfinance banks in Awka local government authority of anambra state, Nigeria. The international journal of economics, commerce and management. United Kingdom. Vol. 3, Issue Number 11. Pp 207- 228

Aphu E.S, Lu X, and Adator S.W (2017). The effects of opportunity international savings and loans credit facility on maize production and health. *Journal of Agricultural Science and Food Research*, JASFR 2017, Vol 8(4): 196

Anetor, I., Adeola, O and Ikpesu, F. (2016). An empirical investigation of the impact of bank lending on agricultural output in Nigeria. A vector autoregressive approach. *The journal of economics and sustainable development*. Vol. 7. No2. pp- 131 - 143

Awotide, B.A; Abdoulaye, T; Alene, A and Mayong, V. M. (2015). Impact of access to credit on agricultural productivity: Evidence from smallholder cassava farmers in Nigeria. *International conference of agricultural economics*.

Babajide, A. (2012). Effect of microfinance on micro and small enterprises (Mase) growth in Nigeria. Journal of *Asian economic and financial review*. Vol. 2. No. 4 Pp 221- 226

Bora, A., Gogoi, P.B., Halim, R. A., Phukan, S. N., and Rahman, B. (2019). Non government organization and its impact on agriculture, Jorhat, Assam.Ethiopia. *East African Scholars Journal of Agriculture and Life Sciences.*Vol. 2.Issues-No. 10

Chandio, A. A; Yuansheng, J. and Koondher, M. A. (2015). Rising Maize Productivity through Agricultural Credit*;* A Case Study of Commercial Bank in Pakistan. *Europian journal of business and management. Vol. 7, No. 32, pp. 159-165*

Chandio, A. C., Habibullah, M., Abdul, R & Jam, G. M. S., (2018); Types, Sources and Importance of Agricultural Credits in Pakistan; *Journal of Applied Environmental and Biological Sciences*; 7(3)144-149.

Chiu, V. J; Khantachavana, L.V.S and Turvey, G.C. (2014). Risk rationing and the demand of agricultural credit. A comparative investigation of Mexico and China. Agricultural finance review, Vol. 74. No. 2, pp. 248 - 270

Creswell, J. W. (2014). *A Concise Introduction to Mixed Methods Research (4th ed.).* Thousand Oaks: SAGE Publications

Duniya, K. P and Adinah, I. I. (2015). Analysis of cotton farmer's accessibility to credit in northern guinea savannah of Nigeria. *Asiaian journal of agricultural extension, economic and sociology*. Vol. 4. No. 4, pp 296 – 301.

Ekise, E. I., Nahayo, A., Mirukiro, D. J., and Nsengiyumva, B. (2013). Analysis of the impact of agricultural input subsidies voucher programme on the livelihood of smallscale maize producers in Kirehe , Rwanda. New York Science Journal. Vol 6. No. 9

Gertler, M., and Kiyotaki, N. (2011). *Financial intermediation and credit policy in business cycle analysis*. In B. Friedman. and Woodford, M. (Editions), Handbook of monetary economics, 3A, North Holland: Elsevier.

Geta, E and Hamiso, T. (2014). Access to microcredit and its effect on crop productivity and household income in Ethiopia. *The global journal of current research*. Vol 5. No. 3, pp 128 - 134

Guley, J. G., and Shaw, E.S. (1960). *Money in a theory of finance.* Washington: Brookings Institution.

Hair, J. F., Black, W.C., Babin, B. J. and Anderson, R.E. (2010). *Multivariate data analysis.* 7th edition. Upper Saddle River, N J: Prentice-Hall.

Joseph.C & Daniel, M. (2013). Study on Bank Credit and Agricultural Output in South Africa. *International Business and Economic Research Journal*. *Vol. 12, No. 4 (2013)*

Kajenthini. A and Thayaparan,A. (2017). Impact of Microfinance Loans on Paddy Production among Small Holder Farmers in Sri Lanka. *Global Journal of Management and Business Research:* Vol. 17. No. 4, pp 23-37

Kinuthia, B. K. (2018). *Credit constraints and agricultural productivity in developing countries: The case of East Africa.* African growth and Development policy (AGRODEP) working paper 0040

Kline, R. B. (2011). *Principles and Practice of Structural Equation Modeling*. N.Y. Press

Kudakwashe, G.M., and He, J. (2019). Impact of availability of credit to small-scale maize farmers, a case of Marondera district. *International Journal of Management Sciences and Business Research.* Vol-8, Issue 6.

Linh, N. T., Long, T. H., Chi, V. L., and Tam, T. L. (2019). Acess to rural credit markets in developing countries: The case of Vietnam. Literature Review

Masoud, N. (2013). Neoclassical economic growth theory. An empirical approach. *Far East journal of psychology and business*. Vol. 11. No. 3, pp 123 – 136

Maziku, P. (2017). Estimating non tariff barrier costs of maize production and marketing for smallholder farmers in Tanzania. A case of Mbozi and Momba districts in Mbeya region. *International journal of plant breeding and crop science.* Vol.4 (2) pp 261 - 267

Methew, K., and Thompson, J. (2005). *The economics of banking. Chichester*: John Wiley and Sons.

Miho, A. (2017). Comparing technical efficiency of maize smallholder farmers in Tabora and Ruvuma regions of Tanzania. Asian Journal of agriculture and rural development. Vol.. Issue 9. Pp 180 - 197

Mustapha, A. A. (2017). Analysis of access to credit and agricultural performance in sub-saharan Africa. *International journal of agricultural economics.* Vol. 2, pp. (160-164)

Mwakaje, G., Elishadai, A., and Gilabi, F. (2013). The impact of microfinance institutions on smallholder farm based on maize and sunflower in Iramba district, Tanzania. *Asian Economic and Financial Review Journal, 2013.* Vol 3(2): pg 227- 242

Nissar, A and Chughtai, M. W. (2015). Impact of agricultural credit on production of wheat crop. . *Journal of agricultural marketing and development.* Vol. 4. No. 2, pp 43 - 51

NBS. (20012). *Statistical business register report 2007/2008*. Dar es Salaam: National Bureau of statistics.

NBS. (2015). *Statistical business register report 2014/2015*. Dar es Salaam: National Bureau of statistics.

Ngegba, M. P. (2016). The impact of village saving and loan association (VSLA) on farm productivity in lowe Banta chiefdom, Siera Leone. *International research journal of social science and Humanities.* Vol. 10. Issue No. 17 pp 200-217

Nsubili, I. (2018). Access to Bank Credit by Smallholder Farmers in Tanzania. A Case Study of Mvomero District.

Nuhu. E., Inusah, A., Ama, R. G., and Sano, Z. M. (2014). Impact analysis of microfinance on crop production in Ghana. *The international journal of academic research in Accounting, Finance and management science.* Vol. 4. No. 3. pp. 97 -108.

Nwanko, F. (2008).The impact of informal credit on agricultural production in the awka south local government authority, Anambra, State, Nigeria. *A journal of cooperative economics and management*. Vol. 4. No. 1. pp 74-94.

Ogunleye, H. (2018). Effect of Access to Microcredit on Productivity and Profitability of Cassava Farming in Osun State, Nigeria. *Journal of Tropical Agriculture, Food, Environment and Extension.* Vol. 17. No. 2, pp 51 – 58.

Ohens, S.B., Ofem, U. I., and Arikpo, D. (2018). Efficiency of cooperative societies in credit delivery to agricultural enterprises in Nigeria. *International journal of environmenmtal and africulture research (IJOEAR).* Vol. 4. No. 3, pp 34 – 46.

Olaniyi, O. A., and Adewale, J. G. (2012). Information on maize production among rural youth: A solution for sustainable food security in Nigeria. Libraries at University of Nebraska-Lincoln: Version 4-2012.

Owusu, S., (2017). Effect of access to credit on agricultural productivity: Evidence from cassava farmers in the Afigya – Kabre district of Ghana. *International journal of innovative research in social sciences and strategic management techniques.* Vol. 4. No. 2, PP 2- 19

Patric, F (1996). Intention-based models of financial support in agricultuel. *14th Annual IntAgr Conference. IntAgr1996* . Italy: University of Napoli Federico .

Park, Hun Myoung, (2011). *Practical guides to panel data modeling: a step-by-step analysis using stata*. Tutorial Working Paper, 'Graduate school of international relations', International University of Japan."

Rajeev.M. and Van, P. (2017). Financial access of the urban poor in India, spring brief in economics

Rashid.S.(2015). "Current Maize Production, Postharvest Losses and the Risk of My cotoxins Contamination in Tanzania"

Sarker, N. I. (2016). Role of banks on agricultural development in Bangladesh. *International journal of ecology and development research.* Vol. 1 (1). pp 010 - 015

Saunders, M., Lewis P. & Thornhill, A. (2012). *Research methods for business students*. 6th edition, Pearson, Essex.

Solow, R.M. (1988). A Contribution of the theory of Economic Growth.*The quartery Journal of economics*. Vol. 70. No. 1. pp 65 - 94

Undry, H.(2015). The role of informal credit on agricultural productivity: An assessment of small scale maize farmer's ultilization of credit in Nigeria. *American Jounal of experimenta agriculture.* Vol. 9. pp 62 - 89

Werner, R. A. (2016). A lost century: Three theories of banking and the conclusive evidence. *International review of financial analysis.* Vol. 46.No. 10, pp 361 – 379

Yusuph,H.O., Ishaia, P., Yusuph, H. A., Yusuph, O., and Shuaibu, H. (2014). The role of informal credit on agriculture: An assessment of small scale maize farmers ultilization of credit in Nigeria. *American Jounal of experimenta agriculture*. Vol. 5. No. 11, pp 36 – 43.