The Effect of Commercial Banks' Agricultural Credit on Agricultural growth in Uganda

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Abstract

Over the past one decade, commercial banks in Uganda have progressively lent credit to agriculture. However, the increasing commercial bank's agricultural credit disbursements have not translated into commensurate increase in agricultural GDP growth. Upon this backdrop, the study sought to examine the short run and long run impact of the commercial banks' credit on agricultural sector growth. Using quarterly time series data sourced from bank of Uganda and Uganda bureau of statistics over the sample period of 2008Q3 -2018Q4, the study applied the Autoregressive Distributed Lag (ARDL) approach to examine that the short run and long term relationship between commercial banks' credit and Uganda's agricultural GDP performance.In the long run, we find credit to have significant positive impact on agricultural output. Credit to production is found to have a much higher impact on agriculture output compared to credit to processing and marketing.In the short run, we find bank credit not to have an instantaneous impact on agricultural output.The study provides evidence that commercial banks' agricultural credit contributes significantly to Uganda's agricultural sector GDP. Specifically, the study provides evidence of the segment of the agriculture value where credit has the highest impact. This paper contributes to providing policy options for improving agricultural GDP performance in Uganda for example de-risking production segment.

Keywords: Commercial bank's credit, agricultural GDP, ARDL bounds test, Uganda

JEL: E40, E50, Q14, Q18

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1. Introduction

Agricultural sector remains one of the most important sector in Uganda's economy. According to statistics from Uganda bureau of statistics, the sector accounts for 65 percent working population. The sector also plays a predominant role of providing food to the ever-growing population both in urban and rural areas. In addition, the sector forms a basis for industrialization in the country by providing raw materials. Notwithstanding its contribution to the economy, agriculture at the various stages of the value chain is susceptible to a number of constraints (Chatterjee and Oza, 2017). One of the most significant constraint is limited access to credit. Farmers, particularly small holder have limited access to credit from formal institutions such as banks partly due to credit policies of these institutions which adversely affect farmers' eligibility to accessing credit.In the bid to address the above challenge, government has under taken a number of initiatives with the major one being Agriculture Credit facility (ACF).The ACF was implemented with the aim of facilitating the provision of medium and long term financing to projects engaged in agriculture and agro-processing focusing mainly in commercialization and value addition (Bank of Uganda, 2009). In addition, the microfinance sector has steadily increased their lending to agriculture.

The ACF initiative coupled with persuasion of commercial banks to lend to agriculture have resulted in steady increase in share and total private sector credit to agriculture by commercial banks, although it's still deemed insufficient. Notwithstanding this increase, agriculture value added as a percentage of gross domestic product (GDP) has steadily decreased from 26.8 percent in 2009 to 21.8 percent in 2017. In addition, growth in agriculture value added has also stagnantly remained low, averaging at 2.7 between 2009 and 2017(UBOS, 2018)[1]. This observed antipodal movements in commercial bank credit and agriculture value added raises questions as to whether the credit has really had any impact on agriculture. A deeper analysis of credit distribution between production and processing and marketing reveals a significant degree of inequality with the latter increasingly taking a lion's share. This raises extra questionsas to whether credit is properly aligned in agricultural sector and whether the inequality is responsible for irresponsiveness of agriculture value added. Thus, the need to examine the impact of commercial bank agricultural credit on agricultural sector output.

Several empirical studies have adopted various methods to examine the effect agricultural credit on agricultural output. These studies have found mixed results in different countries. While some findings suggest a positive and significant impact between agriculture credit and agricultural output (Chisasa and Makina, 2015; Ammani, 2012; Nwokoro, 2017; Udoka*et al.,* 2016; Ahmad *et al.,* 2018; Rima, 2014); some studies reject the findings and report either a negative impact of agriculture credit on output or the impact cannot be directly estimated (Olorunsola*et al*., 2017; Meressa, 2017; Obilor, 2013, Nawaz, 2011; Oyakhilomen*et al*., 2012). However, none of the studies have estimated the short run and long run effects of agricultural credit disbursed to different value chain segments on agricultural GDP, most particularly in Uganda, which motivate further investigation of the relationship between bank credit and agricultural output.

A second empirical question that this study intended to explore is whether there is a long term relationship between commercial banks' agricultural credit and agricultural growth in Uganda. Empirical evidence is abound on the long run and short run relationship between commercial

[1] https://www.ubos.org/explore-statistics/9/

banks' credit and economic growth and results are mixed. While Chisasa and Makina (2015) and Ahmad et al. (2018) found a positive relationship between credit institutions' credit on agricultural output, Olorunsolaet al. (2017) and Oyakhilomen et al. (2012) found a negative relationship which calls for further investigation, most especially whether credit and agricultural output are cointegrated in the long run.

Against this background, this paper examines the effects of commercial banks' credit on agricultural GDP performance in Uganda. The paper employs an autoregressive distributed lag (ARDL) approach to cointegration in order to extract the interactions between agricultural output and commercial bank's credit to agriculture. The unique features of this paper are two: first, we estimate both short run and long run effects of commercial banks' agriculturalcredit on agricultural sector growth in Uganda; secondly, we examine the effect of commercial bank's agricultural credit to production and processing on agricultural growth.

Using the ARDL bounds testing techniques, we find that commercial bank's agricultural credit has a positive role to play in Uganda's agricultural GDP performance. The impact of credit is found to be highest at production compared to processing and marketing value chain segments.
The rest of the paper is organized as follows. Section 2 presents agricultural financing mechanisms in Uganda. Section 3 reviews related literature on the impact of agriculture credit on agricultural output. Section 4 discusses the data and methodology. Section 5 presents results and discussion. Section 6 concludes with key policy recommendations.

2. Agricultural financing mechanisms in Uganda

Agricultural sector plays an important role in the economic development of developing countries through its enormous contribution to GDP (Udoka e*t al*., 2016; Rehman*et al*., 2017; Mbowa*et al*., 2018). In Uganda, agricultural sector contributes about 25 percent of the country's GDP (Mbowa*et al*., 2018). Over the past two decades, there has been an overwhelming need by government to transform the sector from one that is purely subsistence to commercialized sector (characterized by intensive use of improved technologies, value addition, among others). However, this transition calls for increased credit availability on the side of farmers to ignite the transition. Both government and private agricultural credit initiatives have emerged in the wake of agricultural transformation. Key government initiatives include: the Poverty Eradication Action Plan (2004/5-2007/08), the Plan for Modernization of Agriculture, the rural financial services programme (2005), the rural microfinance support project (2003), the microfinance deposit taking institution programme (2003), the Plan for enhancement of sustainable financial services or microfinance outreach plan (2003) and prosperity for all (2005) (Munyambonera*et al.*, 2015). Further efforts to ease access to credit have been observed through the fluctuating trends in central banks rates from 18 percent in 2011 to about 9.5 percent at the end of 2018 (Sserunjogi, 2019).

Apart from government credit initiatives to the sector, private sector has also been instrumental in offering credit to farmers. It is estimated that total private sector credit to agriculture has steadily increased from 12 percent in 2008 to 18 percent in 2017, of which commercial banks accounts for 91 percent of the private sector credit disbursed to agriculture (EPRC, 2018). The growing role of commercial banks in agricultural credit over the years is exemplified by a striking increase in the share of commercial banks' credit to agriculture (Figure 1). The observed

trend could partly be attributed to reforms like ACF which was launched in 2009 and was housed in the commercial banks. Notwithstanding the increasing commercial bank's credit to the sector, varying trends are observed along agriculture value chains (figure 1). Between 2014 and 2018, agricultural processing was the most funded segment by commercial banks, followed by production, while marketing is the least funded along the agricultural value chain. Between 2012 and 2018, processing finance increased from 1.8 percent to 5.9 percent in 2018 of the total commercial lending to agriculture. The proportion of production finance grew at a much steadier rate, increasing from 3 percent in 2010 to about 4 percent in 2018.

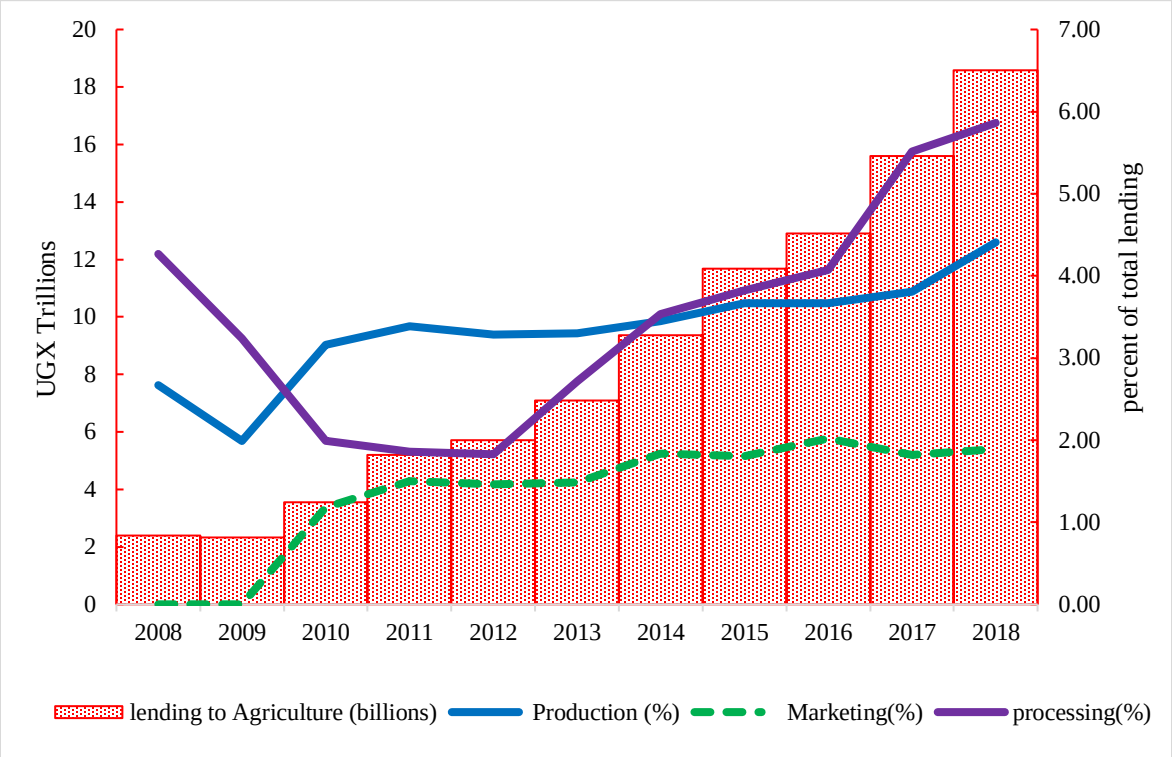

Figure 1: Trends in Commercial banks' lending to agricultural sector

Source: Authors compilation using data from Bank of Uganda

Notwithstanding the observed government and private sector efforts to increase access to credit, the dwindling fortunes of the sector continue to persist (Figure 2). The percentage share of agricultural GDP to total GDP has declined from53 percent in 1983 to 25 percent in 2017. This is a clear indication that increasing commercial bank's agricultural credit disbursements have not translated into commensurate increase in agricultural GDP.While agricultural GDP has not been responsive to agricultural credit, it is not clear which macro level factors are responsible for the observed trends in agricultural growth. In addition, the question of which agricultural value chain segment credit is more effective in delivering agricultural GDP growth is not yet clear, which prompts further investigation. A clearer understanding of both the short run and long run effects of commercial bank's agricultural crediton agricultural GDP can provide better policy options for improving agricultural GDP performance in Uganda.

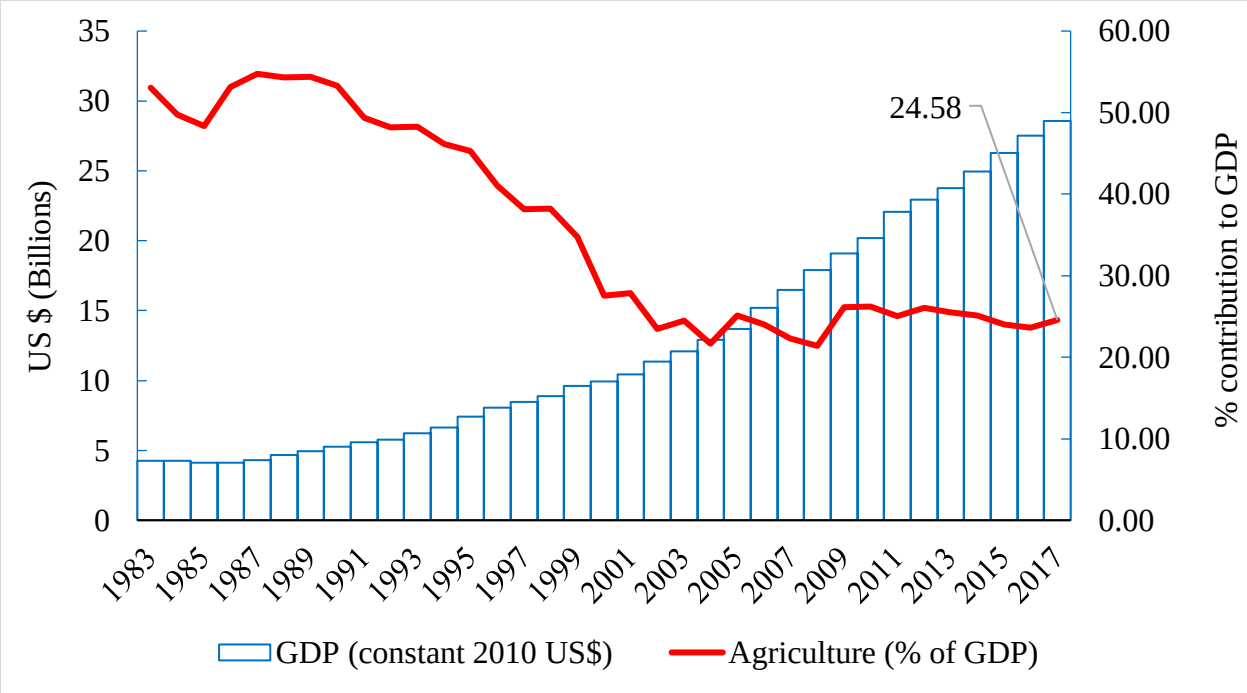

Figure 2: Trend in Uganda's GDP growth
Source: Authors compilation using data from World Development indicators

3. Literature review on the impact of agriculture credit on agricultural output

A large number of studies in different countries have employed time series analysis to examine the causality between agriculture credit and output. Reviewed literature (Chisasa and Makina, 2015; Ammani, 2012; Nwokoro, 2017; Udoka*et al.*, 2016; Ahmad *et al.*, 2018; Rima, 2014; Olorunsola*et al*., 2017; Meressa, 2017; Obilor, 2013; Nawaz, 2011; Oyakhilomen*et al*., 2012) on the effect of agriculture credit on agricultural output shows mixed results. In South Africa, Chisasa and Makina (2015) applied time series data from 1970 to 2011 toinvestigate the dynamic relationship between bank credit and agricultural output. They found that in the long run, credit had a positive impact on agricultural output, but had negative impact on agricultural output in the short run which reflected uncertainties of institutional credit in South Africa.

In Nigeria, Ammani (2012) applied the OLS method to investigate the effect of credit on agriculture. They found that formal credit had a positive influence on productivity of crops, livestock and fishing sectors. Using OLS and error correction model on Nigeria's 1980-2014 data, Nwokoro (2017) found that banks' credit had a positive effect on agricultural GDP. A disaggregation of the effect of commercial banks' credit on agricultural output during 1970-2014 by Udokaet al.(2016)further revealed a positive and significant relationship between commercial banks credit to the agricultural sector and agricultural production in Nigeria. Similar findings were found by Ogbuabor and Nwosu (2017) in their study on the impact of deposit money bank's agricultural credit on agricultural productivity in Nigeria.

Contrary to the findings of Ammani (2012), Nwokoro (2017), Udokaet al.(2016), Olorunsolaet al.(2017) applied nonlinear autoregressive distributed lag model on a time series data from

1992Q1 to 2015Q4 to investigate the relationship between credit to agriculture and agricultural output in Nigeria. The study results showed that there was no evidence of asymmetry in the impact of credit to agricultural output growth in the short-run, but different equilibrium relationships exist in the long-run. They further urged for the need to investigate the extent to which the different components of agricultural credit (production, processing, marketing) affect agricultural output. In addition, Obilor (2013) evaluated the impact of credit disbursed by the commercial banks to the agricultural sector on agricultural productivity, and found that commercial banks' credit to agricultural sector for the period 1984 to 2007 did not have any significant positive impact on agricultural productivity in Nigeria. In addition, Oyakhilomenet al.(2012) applied Johansen cointegration test to examine the relationship between cocoa production in Nigeria and agricultural credit guarantee scheme fund using time series data spanning over the period of 1981 to 2011. The study results indicated that there was no cointegrating relationship between cocoa production in Nigeria and Agricultural credit guarantee scheme fund over the study period. However, none of studies reviewed in Nigeria examined the long run and short run relationship between credit disbursed for production and processing on agricultural output.

In Pakistan, various studies have found positive and significant effect of formal credit on agricultural output. Ahmadet al. (2018) applied autoregressive Distributed Lag (ARDL) bound testing approach on annual time series data from 1973 to 2014 to analyze the long run term relationship between agricultural credit disbursed through formal institutions and agricultural GDP. The empirical estimation indicated the evidence of long-run relationship between agricultural credit and agricultural GDP. Empirical findings further revealed a positive and significant relationship between agriculture credit and agricultural output. Lengthy formal credit procedure was pointed out to be one of the major constraints that limit farmers' access to credit and therefore negatively affect overall agriculture output. Furthermore,Chandioet al. (2016) applied OLS method to examine the effect of institutional credit disbursement on Pakistan's agricultural output over a period of 33 years (1983-2015). The study findings showed that institutional credit had a positive and significant impact on agricultural output i.e a one percent increase in institutional credit disbursement resulted into 1.03 percent increase in agricultural output. The study recommended the quest for financial institutions to make simple procedures in terms of security, documentation and disbursement for small farmers to access credit and therefore enhance agricultural productivity. Contrary to Ahmad (2018) and Chandioet al. (2016) findings, Nawaz (2011) showed that agricultural credit itself does not have direct role in enhancing agricultural output, but its effect on agricultural sector growth is through buying modern inputs like tractors, tubewalls and seeds. However, the studies did not analyse the effect of bank's credit disbursed for production and processing purposes on agricultural output.

In Ethiopia, Meressa (2017) applied a random effects generalized least square (GLS) methods on an unbalanced short panel data (2010-2016) from 16 private commercial banks in Ethiopia. The study findings showed that private commercial banks' credit was not statistically significant in influencing agricultural sector growth.

Using time series data from 2002 to 2012, Rima (2014) examined the impact of the impact of commercial banks' agricultural credit on agriculture GDP in Nepal. The estimated Cobb-Douglas production function showed that agricultural credit flow of commercial banks during the study period positively and significantly impacted Nepal's agricultural GDP. However, the study did

not examine the short run and long term effect of the commercial bank's credit on Nepal's agricultural GDP.

By and large, the reviewed studies have in some countries like Nigeria and Pakistan endeavored to establish the short run impact of agricultural credit on agricultural output, but this remains limited in most of the countries, Uganda inclusive. In addition, apart from Nawaz (2011) who tried to examine the effect of direct and indirect credit in Nigeria, no study has attempted to examine the effect of commercial bank's credit to different value chain segments (production, processing and market) on agricultural output, which presents a research gap in this respect.In addition, reviewed studies in Uganda (Munyambonera*et al.*, 2015) have been carried at a household level, without a thorough investigation of effect of agricultural credit on agricultural output at a macro level.

4. Research Methodology

To achieve objectives of the study, we specified a linear empirical model relating commercial bank credit and agriculture output. In the model we also control for two (interest rates and inflation) factors that have been perceived to affect agriculture production. As earlier indicated, our estimation is structured along three lines; first we estimate the impact of overall commercial bank credit to agriculture on agriculture production, then we separate credit that goes to production from that which is devoted to processing and marketing and then estimate two different models. The three empirical models are therefore given by;

$$lnAGDP_t = \beta_0 + \beta_1 lnAgric\_Credit_t + \beta_2 inflation_t + \beta_3 interestrate_t + \beta_4 lnexchange\ rate_t + \varepsilon_t \quad (1)$$

$$lnAGDP_t = \beta_0 + \beta_1 lnproduction\_credit_t + \beta_2 inflation_t + \beta_3 interestrate_t + \beta_4 lnexchange\ rate_t + \varepsilon_t \quad (2)$$

$$lnAGDP_t = \beta_0 + \beta_1 lnprocessing\_marketing\_credit_t + \beta_2 inflation_t + \beta_3 interestrate_t + \beta_4 lnexchange\ rate_t + \varepsilon_t \quad (3)$$

Where;

$AGDP_t$=Agricultural sector GDP contribution to overall country GDP, measured in billion Uganda shillings,

$lnAgric\_Credit_t$=logarithm of commercial bank credit to agriculture sector,

$lnproduction\_Credit_t$ = logarithm of commercial bank agriculture credit that specifically goes to production,

$lnprocessing\_marketing\_Credit_t$ = logarithm of commercial bank agriculture credit that specifically goes to processing and marketing,

$inflation_t$=Quarterly percentage change in the price of goods and services

interest rate_t = percentage rate at which money is lent out to farmers,

ε_t =Error term,

t=Time trend, in this case from 2008Q3 to 2018Q4.

The three models were estimated using time series econometric techniques. As a rule of thumb in time series analysis, pre-estimation diagnostics particularly stationarity tests are very important. In this study, we carried out unit root test using augmented dickey fuller test. Unit root tests are

particularly very important since regressing a stationary variable on a non-stationary variable can result in spurious regression. But most importantly, the results of the unit root test determine the appropriate estimation technique to be used.

4.1 Sources of data

The paper utilizes quarterly data spanning a 10 year period, from 2008Q3 to 2018Q4. Data on commercial banks' agricultural credit, inflation rates and interest rates on credit were obtained from the Bank of Uganda (BOU), while agricultural sector GDP was obtained from the bureau of statistics (UBOS). It should be noted that unavailability of commercial banks' credit data before 2008 limits the study analysis to only a 10 year period (2008Q3-2018Q4).

The data collected from the above sources was subjected to pre-estimation diagnostics beginning with descriptive statistics and then unit root tests. Results in table 1 show that agriculture GDP for the period under review averaged at 2940 billion shillings, commercial bank credit averaged at 739,093 million shillings, The distribution of commercial bank credit to agriculture between production, and processing and marketing has largely been uneven with the latter taking a lion's share, averaging at 447,844 billion shillings, compared to former which averaged at 292,641 billion shillings.

Table 1: Descriptive statistics for the model variables

Variable	Mean	SD	Minimum	Maximum
Agriculture GDP	2,940.0	592.6374	2,122.84	4,209.31
Agricultural credit	739,092.7	439,737.5	166,525	1,600,000
Credit to production	292,641.8	147,347.5	54,104.2	578,830
Credit to marketing and processing	447,844.2	298,817	110,457	1,100,000
Inflation	7.8	5.847	1.550	24.080
Interest rates	16.3	4.542	8.230	28.000
Exchange rate	2,881.6	582.8487	1,889.93	3,762.42

Having carried out descriptive analysis, we then delve into stationary tests. Augmented Dickey Fuller (ADF) unit root test was used. In carrying out the stationary tests, we considered both trend and intercept in the series. Results in table 2 indicate that log of credit to production and log of credit to marketing and processing are stationary in levels, I(0), while the rest of the variables are integrated of the first order, I(1). This therefore implies that the data set is comprised of a mixture of both I(0) and I(1) variables.

Table 2: Stationarity tests (ADF)

Variable	Unit root test in levels		Unit root test in first difference		Order of integration
	Intercept	Trend and intercept	Intercept	Trend and intercept	
Log Agriculture GDP	0.378	1.422	3.704***	3.750***	I(1)
Log agriculture credit	0.563	2.301	6.492***	6.622***	I(1)
Log credit to production	3.607***	4.304***	3.356**	3.899**	I(0)
Log credit to marketing and processing	0.122	3.616**	5.923***	5.847****	I(0)
Inflation	2.606*	3.317*	3.879***	3.817**	I(1)
Interest rates	4.628*	2.592	2.994**	3.027	I(1)
Log of exchange rate	-1.716	-2.860	-4.433***	-4.417***	I(1)

,,***Significant at 10, 5 and 1 percent levels, respectively*

4.2Model Estimation technique

Given that the data set contains both I(0) and I(1) variables, ARDL and bounds test is the most suitable technique for examining the long run and short run relationship between agricultural sector growth and commercial banks' agricultural credit. The technique is superior to other approaches of cointegration (such as the Johansen and Angel Granger) due to the following: (i) The approach does not require all variables to integrated of order one, as is the case in Johansen; (ii) It can be applied for small sample size such as the one in this particular study; (iii) it also produces unbiased estimates even in the presence of endogenous covariates (Harris andSollis, 2003); (iv) the method can be applied even when the variables have different optimal number of lags; (v) the approach can further estimate the short run and long run relationships between the dependent variable and its predictors.

Based on model 1, ARDL model would be given by;

$$\begin{aligned}
&\Delta lnAGDP_t \\
&= \beta_0 \\
&+ \alpha\big[lnAGDP_{t-1} - \phi_1 lnAgric_{Credit_t} - \phi_2 inflation_t - \phi_3 interest_rate_t \\
&- \phi_4 lnexchange_rate_t\big] + \sum_{i=1}^{p-1} \gamma_i \Delta lnAGDP_{t-i} + \sum_{i=0}^{q-1} \lambda_i \Delta lnAgric_{Credit_{t-i}} \\
&+ \sum_{i=0}^{q-1} \psi_i \Delta inflation_{t-i} + \sum_{i=0}^{q-1} \varphi_i \Delta interest_rate_{t-i} + \sum_{i=0}^{q-1} \theta_i \Delta lnexchange_rate_{t-i} \\
&+ e_t
\end{aligned} \tag{4}$$

Where; α is the speed of adjustment, $\phi_1, \dots, \phi_3$ are long run coefficients while $\gamma_i, \lambda_i, \psi_i$, and φ_i are short run coefficients. Note that ARDL versions for model 2 and 3 are similar to equation 4 with adjustment on the type of credit in the model.

4.4Bounds test

To test for existence of long run relationship, bounds test was applied. This is a Wald test (F-statistic) that tests whether all the long run coefficients are statistically equal to zero. It's performed under the null hypothesis of "no cointegration among the variables in the model". The null and alternative hypotheses are stated as follows;

$H_0{:}\phi_1 = \phi_2 = \phi_3 = \phi_4 = 0$and $H_1{:}\phi_1 \neq \phi_2 \neq \phi_3 \neq \phi_4 \neq 0$

The computed F-statistic is compared with the critical F-values provided by Pesaranet al. (2001). If the computed F-statistic exceeds the upper critical value, the null hypothesis is rejected indicating that the variables are cointegration. If the computed F-statistic is lower than the lower bound critical value, we fail to reject the null hypothesis, and conclude absence of cointegration

5. Results and discussions

While using ARDL model, it's important to confirm existence of a valid long run relationship before proceeding to estimate the short run and long run coefficients. This is done using the bounds test whose results are presented in table 3. Interpreting at 5 percent level of significance, the results indicate that there exists a valid long run (or cointegrating relationship) between agricultural GDP and commercial bank's credit for all the three models (although that for model 3 is deemed week). The computed F-statistics for all the three models are all above the tabulated critical values. As such we cannot reject the existence of a stable long-run (level) relationship among the variables.

Table 3: Bounds test

	Model 1	Model 2	Model 3
F-statistic	4.440	6.202	3.696
10% (lower bound, upper bound)	(2.45 ; 3.52)	(2.45 ; 3.52)	(2.45 ; 3.52)
5% (lower bound, upper bound)	(2.86 ; 4.01)	(2.86 ; 4.01)	(2.86 ; 4.01)
2.5% (lower bound, upper bound)	(3.25 ; 4.49)	(3.25 ; 4.49)	(3.25 ; 4.49)
1% (lower bound, upper bound)	(3.74 ; 5.06)	(3.74 ; 5.06)	(3.74 ; 5.06)

Having confirmed existence of a long run relationship, we then proceed to estimate the short run and long run coefficients. Table 4 presents the results for the three models estimated. In all the three models, the speed of adjustment lies within acceptable limits (-1 to 0) and is statistically significant. The speed of adjustment for model 1 implies that 70.6 percent of the short run deviation in agriculture GDP (brought about by deviations in the predictors) is corrected in the first quarter[2].

The long run results indicate that agriculture credit indeed stimulates agriculture GDP. For instance, one percent increase in overall commercial bank credit results into 0.09 percent increase in agriculture GDP, keeping other factors constant (Table 4: model 1). One percent increase in credit to production results in 13.8 percent increase in agriculture GDP while the samepercentage increase in credit to processing and manufacturing results in 5.9 percent increase

[2]Similar interpretation applies for model 2 and 3

in agriculture GDP. Important to note from the results is the fact that all the long run elasticities are less than one, an indicator of sluggish response of agriculture output to credit. This could be due to other supply constraints other than credit which could moderate the role of credit. The study findings are similar to Nnamochaet al.(2015), Udokaet al.(2016)who found a positive relationship between commercial banks credit and agricultural sector growth in Nigeria.

Table 4: Short run and Long run estimation

Variables	Model 1	Model 2	Model 3
Long Run			
Log agriculture credit	0.0874** (0.0359)		
Log credit to production		0.1380**(0.0563)	
Log of credit to processing and marketing			0.0586**(0.0268)
Inflation	0.0034**(0.0017)	0.0048**(0.0020)	0.0029*(0.0017)
Interest rates	-0.0060***(0.0018)	-0.0089***(0.0026)	-0.0050***(0.0017)
Log of exchange rate	0.1720* (0.0881)	0.1470 (0.0954)	0.2180** (0.0824)
Short run			
D. Log agriculture credit	-0.0369 (0.0595)		
D. Log credit to production		-0.0396 (0.0360)	
D. Log of credit to processing and marketing			-0.0100 (0.0589)
D. Inflation	-0.0031*(0.0018)	-0.0034*(0.0017)	-0.0029 (0.0019)
D. Interest rates	0.0035 (0.0023)	0.0030 (0.0021)	0.0033(0.0024)
D. Log of exchange rate	0.0091 (0.1100)	0.01380 (0.1010)	0.0072 (0.1130)
Constant	3.8890***(1.2010)	3.0440*** (1.0300)	4.0510*** (1.3280)
ECT	-0.7060*** (0.2080)	-0.5870*** (0.1860)	-0.7310*** (0.2250)
Observations	37	37	37
R-squared	0.543	0.611	0.504

,,***Significant at 10, 5 and 1 percent levels, respectively*

The results also suggest that credit to production has a higher impact on agriculture GDP than credit to processing and marketing. This however is a paradox since the observed trend in agriculture credit reveals that processing and marketing continue to enjoy the lions share.This implies the lower end of the value chain which is associated with the highest elasticity is ignored in preference for high end of the value chain. This perhaps is due to the high risks associated with production stage. In the short run, credit to agriculture appears not to have any significant impact on agriculture GDP. This however is not surprising given the long time lag between production and marketing associated with some crops, but also other production rigidities which result into inelasticity supply.

Regarding the control variables, increasing interest rates is found to deter agricultural growth. This confirms the theoretical postulations that an increase in the rate of interest on borrowed funds borrowed discourages farmers from borrowing and thus leads to less agricultural investment. This is in line with Udokaet al.(2016)who found a negative relationship between interest rate and agricultural output in Nigeria.

Inflation is found to have a positive impact on agriculture sector growth. Possible explanation is the fact that inflation in the country has been largely driven by food prices mainly as a result of bad weather rather than increase in input prices. Our results contradict Olatunjiet al. (2012) who found an inverse relationship between inflation and agriculture production.The impact of exchange rate on agriculture production is marginally significant. Suggesting that movements in exchange rate has minimal impact on agriculture GDP.

To ascertain the robustness of the results, various diagnostic tests were carried. These included; serial correlation LM test (Breusch Godfrey), Heteroskedasticity test (Breusch Pagan test), omitted variable test (Ramsey RESET), Normality test (Jarque-Bera test) and Multicollinearity test (Variance Inflation Factor). Results are presented in table 5.

Table 5: Diagnostic tests

	Test	Model 1	Model 2	Model 3
Diagnostic tests	Serial correlation	0.3659	0.4550	0.1236
	Heteroscedasticity	0.8931	0.1068	0.4211
	Ramsey RESET	0.1386	0.2774	0.0621
	Normality	0.6479	0.1817	0.1436
	Multicollinearity	8.15	7.84	7.95

Results in table 5 show that all the three models pass the diagnostic tests since the p-values associated with the various tests are all above 0.05. Specifically, all the models do not suffer from serial correlation; all models exhibit constant variance; models do not suffer from omitted variable bias; the residuals of the models are normally distributed; and the models do not suffer from multicollinearity.

6. Conclusions and policy options

Notwithstanding the increasing efforts by government to increase access to credit through commercial banks disbursements, growth in agriculture output continues to stagnate, suggesting increase in commercial bank credit to agriculture doesn't result in commensurate increase in agriculture output. Upon this backdrop, this study examined the impact of the commercial banks' credit on agricultural sector growth decomposing credit into two; credit to production and credit to processing and marketing. Quarterly time series data sourced from Bank of Uganda and Uganda Bureau of statistics over the sample period of 2008Q3 -2018Q4 was analyzed using Auto Regressive Distributed Lag (ARDL) approach. The study found that commercial banks' credit has a positive role to play in agricultural GDP performance. The results also point to the fact that credit to production has a higher impact on agriculture GDP than credit to processing and marketing, yet the latter receives a lion's share of the credit.

The positive effect of commercial banks' agricultural credit to agricultural GDP therefore calls for more allocation of credit to the agricultural sector in Uganda. This can be achieved through lowering interest rates charged by commercial banks and increasing accessibility of commercial bank loans by opening up branches in rural areas. Given the highest impact at production stage, there is need to increase credit flow to production particularly by reducing credit risks associated with this stage. In this regard agriculture insurance would be of immense importance. Therefore

government needs to fast truck agriculture insurance and scale it up to cover as many farmers as possible.

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