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BANK CREDIT TO AGRICULTURAL SECTOR AND ITS PRODUCTIVITY IN ETHIOPIA

Bedasa Taye ENGIDA
Rift Valley University, Ethiopia

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Abstract:
this study, efforts were empirically to inspect the long-run association of total outstanding bank credit to the agriculture sector and its productivity in Ethiopia by employing a co-integrated VAR model technique, with annual data running from 1981–2015 agricultural productivity and total bank credit to the agricultural sector as variables of interest, and real government capital expenditure on agriculture, rural population, and seasonal break (dummy) as supplementary variables. A 1% permanent increase in agricultural bank credit was linked to a 0.13 percent increase in agricultural productivity. The speed of the adjustment coefficient was found to be negative and significant with 0.515 values, indicating that 51.5 percent of the deviation from long-run equilibrium caused by a disturbance and/or a shock in the system was eliminated within a year. Unlike to previous studies the financial development-economic growing nexus, there exist the absence of empirical research on causal association between agriculture productivity and bank credit to sector, at least as per the literature review for this study in Ethiopia. In summary, small-holder farmers in particular, and agro-industrial-based entrepreneurs in general, were excluded from bank credit in Ethiopia for a long time.
Keywords:
Agricultural productivity, Bank credit, Causality, Co-integration, Ethiopia

1. Background of the Study

Agricultural credit is considered one of the strategic resources for pushing production to the high horizons consequently, raising the living standards of the rural poor farming community. It allows producers to satisfy the cash needs induced by the production cycle which characterizes agriculture: land preparation, planting, cultivation and harvesting of the crops are typically done over a period of several months in which very little cash revenue is earned, while expenditures on materials, purchased inputs and consumption need to be made in cash. Cash income is received a short time after the harvest. In the absence of credit markets, farmers would have to maintain cash reserves so as to facilitate production and consumption in the next cycle. The availability of credit allows both greater consumption and greater purchased input use, and thus increases the welfare of the farmers(Nzomo and Muturi, 2010).

Despite efforts to enhance industrial production and employment in the manufacturing sector over the years, agriculture has been the primary driver of Ethiopia's economy and food security in the long- run. It constitutes 41.4 % of the country's total output, 83.9% of foreign exchange earnings, and 80% of the total labor force (Matouš, Todo and Mojo, 2013). Smallholder agriculture productivity in Ethiopia is described by a low level of productivity, fluctuations in agricultural production caused by subsistence agriculture, outdated farming practices, inadequate irrigation supplies, a lack of or misuse of modern farm technology such as fertilizer, herbicides, high yield variety seeds, and machinery(Chamberlin and Schmidt, 2013)

One reason Ethiopia's agriculture sector produces at a minimum level is that incomes are insufficient to cover farmers' consumption and expenditures while also allowing them to reinvest in their crops. Farmers frequently suffer a deficiency of capital to adopt modern agricultural technologies where subsistence agriculture prevails and small-holder farming dominates the overall economy of the country. As a result, short-term credits with favorable conditions for seasonal inputs such as fertilizer, improved seeds, insecticides, and herbicides are often preferred because the higher return may be obtained rapidly during the crop season. While advocated and seen as critical to agricultural growth, the use of credit has been envisioned as one method of facilitating technology transfer(Matsumoto, Yamano and Bank, 2011).

Access to financial services for agricultural producers and agribusinesses is critical in Ethiopia to unlock the country's agricultural potential and fund the sector's expansion farm inputs, Credit, savings, payment, and insurance services are all critical; the latter three are essential in and of themselves and may also present chances to expand agricultural credit availability(Zewdie, 2015).

Until recently, few development theorists and practitioners gave small farmers much consideration; rather, they saw the as the principal essence of the backwardness that developing nations were supposed to reject in order to imitate the sophisticated major economies (Islam, 2014). The agriculture sector, like many other sectors, is enhanced by timely access to sound investment services. One of the main barriers to changing the livelihood of smallholder agriculture sector is a lack of access to appropriate credit services. An increasingly common strategy for combating poverty is to provide access to credit services for small farmers(Gurmessa and Catherine, 2017)

In general, Ethiopia's small farmers have been excluded from banks credit market. This is evident from the total amount of bank credit that went to rural peasant sector. For instance, out of the overall supply of rural credit through both Agricultural Industrial Development Bank and Commercial Bank of Ethiopia only 9% went to peasant sector on average during 1982-1992. This means the lion share of banks credit to the agricultural sector has been absorbed by the insignificant large-scale mechanized agriculture in the country designates that the causality also running from the former to the later. Therefore, these facts must be supported by the causal relationship between agricultural sector productivity and banks credit to the sector.

Unlike to previous studies the financial development-economic growing nexus, there exist the absence of empirical research on causal association between agriculture productivity and bank credit to sector, at least as per the literature review for this study in Ethiopia(see, (Roman 2012, Murty, Sailaja, and Demissie 2012, and Meressa 2017). The literature only revealed the magnitude and it doesn't address the issue of a causal association of bank credit and agricultural productivity, as the finance-growth nexus. The primary objective of this study was to inspect banks' credit to agriculture and its productivity in Ethiopia with the specific objectives: (1) To inspect long-run equilibrium and short run dynamic properties of banks' credit and agricultural productivity in Ethiopia. (2) To identify the direction of causality between agricultural productivity and banks' credit. (3) To analyze the impulse response (the propagation mechanism of shocks) and variance decompositions long-run forecast). Specifically, the study was aims to response the basic questions of: (1) Is there a relationship between bank credit and agricultural productivity in Ethiopia both long-run equilibrium and short-term dynamic? (2) Can banks' credit and agricultural productivity have bidirectional causality in Ethiopia? (3) Is banks' credit the main source of variation for agricultural productivity in Ethiopia.?

Since there is scarce empirical research on the causal relationship between banks' credit, and agricultural productivity at sub-sector in Ethiopia, the current study was an attempt to investigation of long-run and short-run causality which may help both the government and policy designers as a focal point for agricultural and bank credit policy intervention. Second, it can be used as a background paper for agricultural stakeholders who need recent information on this area in the Ethiopian context. Third, at the academic level, the current paper adds something valuable to the existing literature as since the association between banks' credit, and agricultural productivity is concerned. Fourth, it can also be used as a springboard for further research on this particular area.

2. Methodological Approach

The paper chiefly relied on secondary sources of data in order to attain study objective. Accordingly, yearly time series data covering from 1981 - 2015 was employed for each variable entering the model: Agricultural productivity and banks credit to the sector as the interest variables and government capital expenditure, rural population(proxy of agricultural labor force) and seasonal break(dummy) as auxiliary variables. While data on banks credit to agriculture was collected from the Central Bank of Ethiopia, World Bank and Ministry of Finance and Economic Development of Ethiopia. Except rural population and seasonal break all the rest are measured in million real terms by local currency.

2.1. Model Specification

Based on evidence from both theoretical frameworks as well as empirical literature, the following model was specified to show the link between agricultural sector productivity and bank credit to the sector in Ethiopia

$$lAP_t = \beta_0 + \beta_1 lBC_t + \beta_2 lGCE_t + \beta_3 lRP_t + SBR_t + \varepsilon_t \ldots \ldots \ldots \ldots \ldots \ldots \ldots \ldots \ldots \ldots (1)$$

Where:
lAP_t– Agricultural Productivity in logarithms with time t,
lBC_t - Bank Credit to the agricultural sector in logarithms with time t,
GCE_t-Government Capital Expenditure to agricultural sector in logarithms with time t,t
RP_t-Rural Population numbers in logarithms with time t,
SBR_t - Seasonal break dummy at time t and
ε_t , Stochastic shock.

2.2. Econometric Approach

Evidence shows that a number of empirical research used a co-integrated VAR approach to inspect the association of the finance sector-economic growth in Ethiopia; see, for example (Fantaye and Aberra, 2011, K. Sreerama et al., 2012). Similarly, this approach was caried out to examine the association of agriculture productivity (proxied by agricultural value-added per hectare) and bank credit to the sector.

2.2.1. The Unit Root Test

Time series data's stationarity or non-stationarity can have a significant impact on its behavior and properties over time (Chris Brooks, 2008). Even though there are Dickey-Fuller and Phillips-Perron (PP) tests, it is common practice to apply Augmented Dickey-Fuller (ADF) tests because it has high power against the trend of stationary alternatives, and it is widely practiced in most empirical studies. For this reason, the researcher was relied more on ADF, and to this end, except for seasonal break, all variables are subjected to these tests.
No trend or intercept in the augmented Dickey-Fuller (ADF) test

$$\Delta y_t = \delta_1 y_{t-1} + \sum_{i=1}^{n} \theta_i \, \Delta y_{t-1} + \varepsilon_t \ldots \ldots \ldots \ldots \ldots \ldots \ldots \ldots \ldots \ldots (2)$$

ADF test with no trend but intercept:

$$\Delta y_t = \delta_0 + \delta_1 y_{t-1} + \sum_{i=1}^{n} \theta_i \, \Delta y_{t-1} + \varepsilon_t \ldots \ldots \ldots \ldots \ldots \ldots \ldots \ldots \ldots \ldots (3)$$

Likewise, test with both trend and intercept:

$$\Delta y_t = \delta_0 + \delta_1 t + \delta_1 y_{t-1} + \sum_{i=1}^{n} \theta_i \, \Delta y_{t-1} + \varepsilon_t \ldots \ldots \ldots \ldots \ldots \ldots \ldots \ldots \ldots \ldots (4)$$

Hypothesis:
H0: $\delta = 0$, (i.e., the data must be differentiated in order for it to be stationary) against
H: $\delta < 0$ (i.e., Since the data is stationary, there is no need to differentiate it (Endres 1995).

2.2.2. Optimal Lag Specification

The model with the lowest AIC or SIC value is typically recommended. Similarly, among the ICs that provide the majority of the lag, the best optimal lag length is chosen. In fact, for this we used a mixture of both methods. As a result, a general-to-specific approach is used to determine the best ideal lag duration, begin with the maximum lag of 2 (Since the data is annual). The values of various lag length selection criteria in the unrestricted VAR model are then examined in each of these models. Finally, the Wald Lag-Exclusion Test was performed to ensure that the VAR system covered the lags with significant information content.

2.2.3. Identification of Co Integrating Vectors

The likelihood ratio Johansen (1988) test is based on maximum likelihood estimation of the ECM with assumptions made about the trend or intercepting parameters and the number k of co-integrating vectors, followed by likelihood ratio tests.

$$\lambda_{trace} = -2\log(Q) = -T\sum_{i=r+1}^{n}\log\left(1-\widehat{\lambda_i}\right), r = 0,1 \dots, n-2, n-1 \dots\dots\dots\dots..(5)$$

$$\lambda_{max=} - T\log(1-\lambda_{r+1}), r = 0,1 \dots, n-2, n-1 \dots\dots\dots\dots\dots\dots\dots\dots\dots\dots\dots\dots\dots (6)$$

When T is the sample size, I denote the Eigen value from the matrix, n denotes the number of variables in the system (in this example, n=k), and r denotes the number of linearly independent co-integrating vectors under the null. The trace test contrasts the alternative hypothesis, that there are more co-integrating vectors than r, with the null hypothesis, that the number of co-integrating vectors is less than or equal to r. The largest Eigen value is 0 and no tests are run when the matrix rank is zero. If the greatest Eigen value is nonzero and the matrix rank is at least one, there might be more cointegrating vectors. According to the null hypothesis, there is no distinction between the two groups.

2.2.4. The Vector Error Correction Model

It is possible to construct a VECM that shows both the dynamic and long-run interaction among the variables if there is a long-run relationship among the variables. If there is only one co-integrating vector and endogenous and exogenous factors are identified in the long-run analysis, it is straightforward to develop the VECM by conditioning on the exogenous variables. Since disequilibrium makes it possible to modify the long-run model, the VECM provides insights into both the short- and long-run components of the system. This is attained using the following nx1 random variable vector expression of pth order error correction VAR.

$$\Delta Z_t = \alpha_0 + \Pi_{t-1} + \Gamma_1\Delta Z_{t-1} + \Gamma_2\Delta Z_{t-2} + \cdots \Gamma_p\Delta Z_{t-p} + \varepsilon_{t=} = \alpha_0 + \Pi_{t-1} + \sum_{i=1}^{p}\Gamma_i + \varepsilon_{t=} \dots\dots\dots (7)$$

Where Π is a matrix carrying information regarding long-run association; supposing that Π is a reduced form 0 < r < k such that it may be written as Π=αβ' with α is the rate of adjustment to equilibrium coefficient and β' the long-run matrix of coefficients. To correct the disequilibrium, in the cointegrated vector(s), the residuals from the equilibrium regression ought to be used to estimate the VECM. For the above equation (7) VAR model, the VECMs with exogenous variables will be estimated as follows.

$$\Delta lAP_t = \delta_1 + \Pi_{t-1} + \sum_{i=1}^{p}\alpha_{1i}\Delta lBC_{t-1} + \sum_{i=1}^{p}\beta_{1i}\Delta lGCPE_{t-1\ 1i} + \sum_{i=1}^{p}\theta_{1i}\Delta lRP_{t-1} + SBR_{t-1} + \lambda ecm_{t-1} + \varepsilon_{1t} \dots\dots\dots\dots\dots\dots\dots\dots\dots\dots\dots\dots\dots\dots\dots\dots (8)$$

Were, ecm_(t-1). is the error correction term indicating lagged residual from co-integrating relationships, and Δ is the first difference of the variables (from the residuals of the long-run equation).

2.2.5. Structural Vector Autoregressive (SVAR) Analysis

There should be causality in at least one direction in the system, if a co-integration is found. Granger and Lee (1989) stated that a causality test must be exist in both an Error Correction Model (ECM) and a Vector Error Correction Model for the VAR model (VECM). The following is the Granger causality hypothesis between agricultural productivity (AP) and bank credit (CB) to the sector:

$$\Delta lAP_t = \delta_1 + \sum_{i=1}^{p}\alpha_{1i}\Delta lCB_{t-i} + \lambda ecm_{t-1} + \varepsilon_{1t} \dots\dots\dots\dots\dots\dots\dots\dots\dots\dots\dots\dots\dots\dots\dots\dots\dots (9)$$

$$\Delta lCB_t = \delta_2 + \sum_{j=1}^{p} \beta_{1j}\Delta lAP_{t-j} + \lambda ecm_{t-1} + \varepsilon_{2t} \ldots \ldots \ldots \ldots \ldots \ldots \ldots \ldots \ldots \ldots \ldots \ldots \ldots \ldots \ldots \ldots \ldots (10)$$

Hypothesis;
H0: There is no causal association between the two variables in the short- and long-long-run;
Ha: There is a causal association between the two variables.
Rejecting the null hypothesis means variables have granger causality. Loss to the null hypothesis rejection, on the other hand, means that the past values of independent variables do not predict the dependent variables.
The variance decompositions show the percentage of the variance in the forecasting for each variable in the system that is likely to have contributed to its own discoveries and the innovation to other variables in the system, whereas the impulse response function attempts to trace an endogenous variable's response to a change in one of the innovations in the VAR system (Kim, Shin and Lee, 2006). In addition to the tests mentioned above, the study would also run diagnostic tests for heteroskedasticity (Breush Pagan-Godfrey test (ARCH test), serial correlation LM test), residual normality (Jarque Bera test), and model stability.

3. Econometrics Results and Discussion

According to Figure 4.1, the highest and lowest growth rates of total outstanding bank credit to the agricultural sector were nearly 23% and 2% in 1982 and 1983, respectively, during the Derg regime. Similarly, the highest and the lowest growth rates of agricultural sector productivity were registered in 1985 (about 30 percent) and 1984 (about 14.0 percent), respectively.

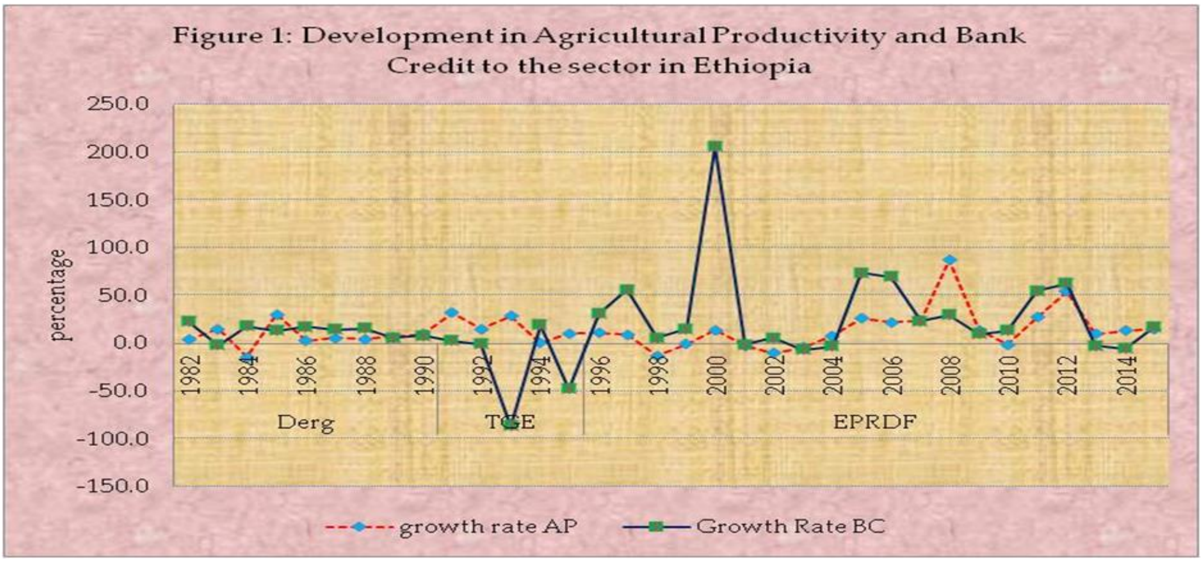


Figure 1: Trend of agricultural productivity and bank credit
Source: Personal estimation based on NBE time-series data

The worst decline in bank credit to agriculture was experienced throughout the transitional period. Agricultural productivity, on the other hand, remained relatively stable over the same time span. Bank lending to the sector has increased, and its growth rate has been positive, albeit with constant fluctuation, particularly after 1999.
It was evident that banks' credit to the sector has increased following the recurrent drought in the country. This was revealed by a growth rate of bank credit to agriculture during the periods of 1982, 1984, 2000, 2006, and 2015. Overall bank credit to agriculture in Ethiopia has declined in the 1990s and 2000s as compared to the 1980s. For example, bank credit to the agriculture sector from 1982 to 1990 was (8.4%), from 1991 to 2000 (8.3%), from 2001-2010 (5.7%), and from 2011 to 2015 (3.01%), implying that the Ethiopian agricultural sector has become neglected by bank credit.

3.1. Variables Plot Against Time at Their Level

It can be seen from figure. 2 that the series fluctuate around their long-run average somehow with a positive trend and, estimated by I(1) processes (figure. 2).

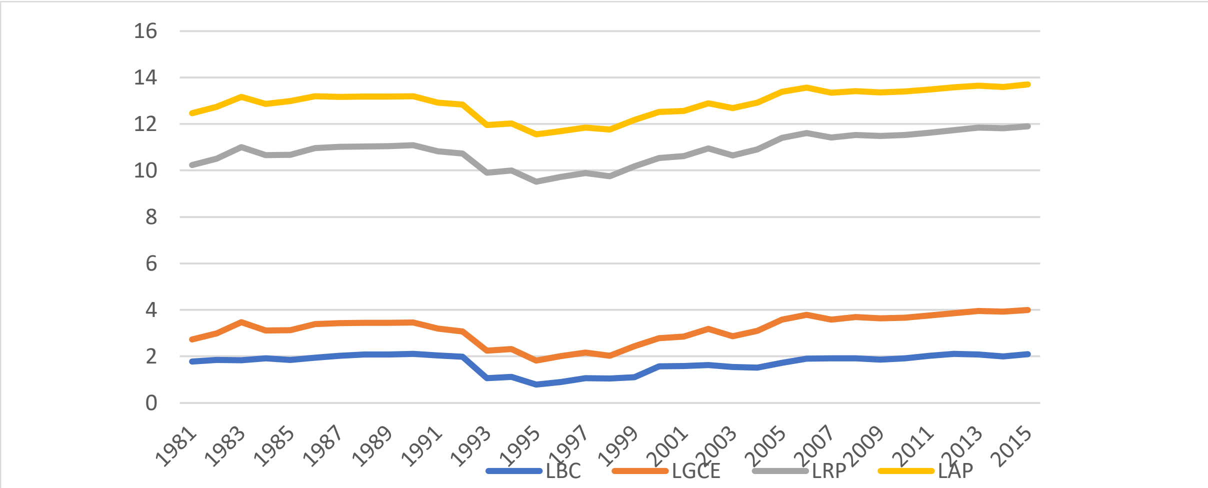


Figure 2: Variables plot against time at their level

Source: Own computation based on time series data from NBE

3.2. Variables Plot Against Time at Their First Difference

Even though all of the variables at their level showed trends or apparent level shifts over time, the first difference appeared to be mean-reverting. This insight was useful when performing the formal stationarity tests in the following section. For example, both series' graphical inspection clearly demonstrates the presence of a positive trend, hence trend should be included during the unit root test. Therefore, the researcher assumed that all variables would be stationary at I (1).

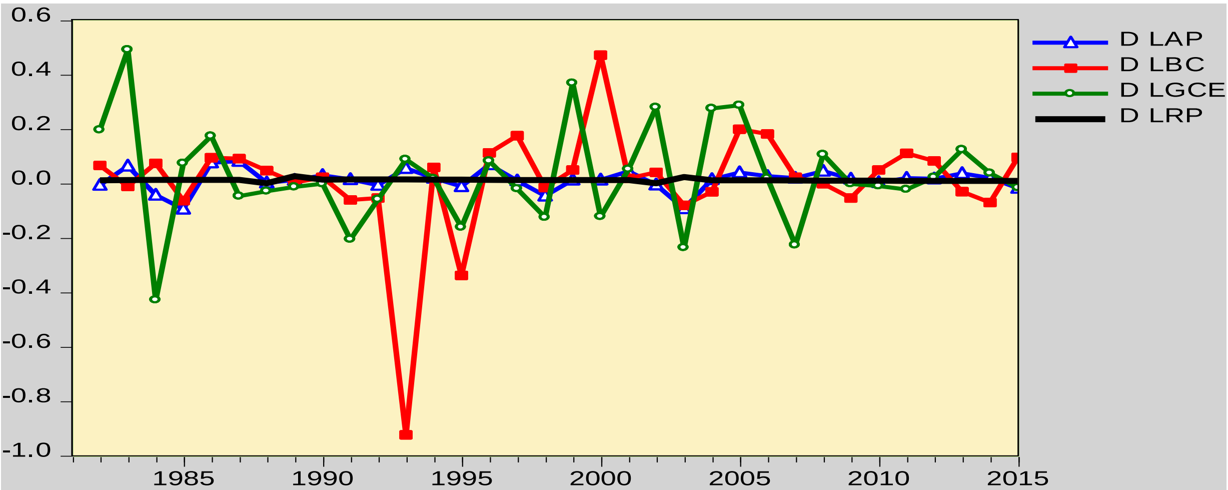


Figure 3: Variables plot against time at their first difference

3.3. Unit Root Tests Result

Table 1: ADF and PP unit root tests of the series at level and first difference.

variables	Augmented Dickey-Fuller test				Phillips-Perron test			
	level		First difference		Level		First difference	
	intercept	Inter & trend	intercept	Intercept &trend	intercept	Intercept & trend	intercept	Intercept & trend
lAP	-0.758	-2.996	-6.987*	-6.927*	-0.415	-3.128	-11.23*	-10.89*
lBC	-1.356	-1.381	-5.457*	-5.468*	-1.559	-1.560	-5.488*	-5.468*
lGCE	-1.878	-2.675	-7.619*	-8.531*	-1.835	-2.821	-8.267*	-8.35*
lRP	-2.610	0.146	-7.391*	-8.479*	-2.564	-0.698	-7.251*	-8.612*
Critical value								
1%	-3.639	-4.253	-3.646	-4.263	-3.639	-4.253	-3.646	-4.263
5%	-2.951	-3.548	-2.954	-3.553	-2.951	-3.548	-2.954	-3.553
10%	-2.614	-3.207	-2.616	-3.209	-2.614	-3.207	-2.616	-3.209

Shows significance at all significance

SIC determines each autoregressive process' optimal lag length for the ADF test.
The test results were consistent with a graphical examination of the variables' integration. The ADF and PP tests failed to reject the null hypothesis that variables had unit roots at their levels, as can be observed from the test results. As opposed to that, , critical values for all series significantly rejected the null hypothesis of unit roots at first differences, showing that all variables must undergo once difference in order to become stationary and return to their long-run mean. The test results also go with graphical inspection (i.e., figures 1 & 2) of the integration of the variables earlier.

Table 2: Selection criteria for the optimal lag for VAR

Lag	LogL	LR	FPE	AIC	SC	HQ
0	82.08255	NA	1.32e-07	-4.489	-4.127	-4.368

1	233.5952	247.929*	3.63e-11*	-12.703	-11.614*	-12.337*
2	250.5596	23.64733	3.65e-11	12.761*	-10.947	-12.151

Denotes the lag order chosen by the criterion. FPE: Final prediction error, LR: sequentially modified LR test statistic (each test at 5% level), AIC, SC, and HQ are the Akaike, Schwarz, and Hannan-Quinn information criteria, respectively.

As seen in table.2, all information criteria were chosen with one lag, as expected, with the exception of the AIC (since the data is annual). The VAR lag exclusion Wald test (Table 3) was used to make sure that lags with significant information values weren't eliminated from the VAR model. The Lag Exclusion Wald test similarly shows that just the first lag was appropriate at a 5% significance level.

Table 3: The Wald test for VAR lag exclusion

Statistics from the chi-squared test for lag exclusion: P-values are the numbers in [].					
	LAP	LBC	LGCE	LRPOP	Joint
Lag 1	408.8781 [0.00000]	120.3997 [0.00000]	107.2678 [0.00000]	20169.08 [0.00000]	25332.49 [0.00000]
df	4	4	4 4	4	4

Table 4: Summary results of the Johansen cointegration test

Data Trend:	None	None	Linear	Linear	Quadratic
Test Type	No Intercept	Intercept	Intercept	Intercept	Intercept
	No Trend	No Trend	No Trend	Trend	Trend
Trace	1	2	1	1	1
Max-Eig	1	1	0	1	1

Denotes rejection of the hypothesis at the 0.05 level, ** MacKinnon-Haug-Michelis (1999) P-values for all Max-Eigenvalue cases.

As previously stated, the model with the lowest SIC value is thought to be the best. SIC chose model 2 (none, intercept, and no trend) to be utilized in the VECM on the basis of the summary test results for cointegration by Johansen. We determined that the variables have a valid long-run association based on this finding. In other words, the I (1) variables that entered the model have a unique long-run solution and thus a stable long-run relationship. As a result, Granger causality testing, VECM formulation, impulse response function execution, and variance decomposition are all viable options.

3.4. Long- and Short-Run Causation in the ECM

The outcomes of Table 5 reveal that, when LAP is the dependent variable, the long-run co-integrated coefficient for the error component was negative and significant at the 5% level of significance. The rejection of null means that there is a long-run causal relationship between the independent and dependent variables, i.e., banks' credit can granger cause to increased agricultural productivity. However, the sign of ECT was identified to be positive and insignificant at every significance level when (lBC) is dependent implying that no long-run causality runs from agricultural productivity to banks credit. Similarly, there was no short-run causality neither from D(LBC_(-1)) nor from D(LAP_(-1)) since all values were not significant (as p values above 0.05). Therefore, we cannot rule out the null hypothesis, which states that there was no direct causal connection between the independent and dependent variables. This study's findings were consistent with a unidirectional causality connecting bank loans to agricultural productivity over the long run (see table 5).

3.5. Long-Run Dynamics: VECM

The following equation was extracted from the Johansson long run co-integration and it can be rewritten as follows:

$$\mathrm{LAP_t} = -13.969 + \underset{(3.2)}{0.130\mathrm{LBC_t}} - \underset{(4.2)}{0.337\mathrm{LGCE_t}} + \underset{(10.8)}{1.582\mathrm{LRP_t}} + \mathrm{u_t} \dots\dots\dots\dots\dots\dots\dots (11)$$

Where, the value in parenthesis is t-statistic.

The co-integrating coefficient for all variables entered the model was significant at 5% significance level. For bank credit to the agricultural sector, the cointegrating coefficient's magnitude and sign were both reasonable and expected, respectively. Since the variables are in logarithmic form and only one cointegrating vector is estimated, this co-integrating coefficient can also be interpreted as long-run elasticity. In light of this, an increase of 1% in bank credit to the agriculture sector is predicted to increase agricultural productivity by 0.13 % when other factors stay the same. The result that accesses to bank credit by farmers will stimulate agricultural productivity in Ethiopia, in the long- run, is similar to many earlier findings for instance, by, (Chisasa and Makina, 2015, Nnamocha and Eke, 2015, and Adeola and Ikpesu, 2016) as far as the association between bank credit and agricultural output is concerned

Similarly, a 1% permanent increase in the agricultural labor force will stimulate agricultural productivity by about 1.58% citrus paribus. The results of a study by (McIntire, Bourzat and Pingali, 1992) support the concept that population growth may lead to a return to specialization due to increased competition between crops and livestock for land and water, as well as the development of infrastructure and markets that create specialization more profitable through the introduction of intense in labor crops. However, the sign of government capital expenditure on agriculture is not as expected. A 1% permanent increase in government capital spending on the agricultural sector will diminish agricultural productivity by almost 0.34 % in the long-run. The negative long-run effect was also identical to findings by Mudaki and Masaviru (2012) in Kenya, supporting a crowding-out effect of government capital expenditure on agriculture.

An additional finding from the equation (11) was that the coefficient of error correction term of agricultural productivity has the reasonable sign and statistically significant at 1% and the agricultural productivity is adjusted in the short-run by 51.5 % of the earlier divergence from equilibrium, with the speed of adjustment to the equilibrium being 51.5 %. In contrast, the coefficients of error correction components for bank credit and rural population had a positive sign and were not statistically significant, suggesting that any shock to the system will result in a deviation from equilibrium and make the system unstable.

3.6. Short-Run Dynamics: VECM

The short-run restricted co-integrated coefficient of the lagged value of agricultural productivity caried positive sign and significant at a 10% significance level, indicating short-run agricultural productivity in the current period is influenced by the last year of agricultural productivity.

On the other hand, the co-integrated coefficient of the lag value of banks' credit was negative and insignificant to affect the present value of agricultural productivity in the short run, i.e., a 1% rise in bank credit causes 0.03% decline of agricultural productivity.

At all levels of significance, the real government capital spending coefficient was positive in the short-run and it becomes negative in the long term. From the point of view of Ethiopian government policy and strategy, the significant and negative long-run effect of government outlay on productivity of sector is desirableIn fact, it is expected that agriculture will only play a significant role in the long-run of the Ethiopian economy. This will require shifting government capital expenditure to the industrial sector and promoting favorable conditions for industry to play a vital role in the long-term of the economy.

Moreover, the short-run dynamic equation above also reveals that the co-integrated coefficient of the lagged value of the rural population was positive but insignificant enough to elucidate the variation of the current agricultural productivity in the short run.

Finally, the error correction term's coefficient (ect (-1)) was negative and significant, indicating that if any short-term oscillations of independent and dependent variable will result in a stable long-run relationship between the variables. The coefficient ECT (-1) implies that the departure from the long-run equilibrium in one period is adjusted by size of that coefficient in the next period. The past shock in our model was adjusted or eliminated, and the system returned to the mean reversion at a rate of 51.5 % a year.

The general form of the short-run dynamics model, with 1 lag on all variables except the seasonal break, is:

$$lAP_t = -0.004 + 0.37lAP_{-1} - 0.03BC_{-1} + 0.08lGCE_{-1} + 0.83lRP_{-1} + 0.0007SBR - 0.52ect_{-1} \ldots\ldots\ldots\ldots(12)$$
$$(0.081) \quad (0.395) \quad (0.04) \quad (0.573) \quad (0.964) \quad (0.0017).$$

where,the values in parenthesis are p-value,and ecm_(t-1,) is a unique co-integrating vector. In this equation, all variables were stationary; they were first differences of log levels except seasonal break which was stationary in nature at I (0).

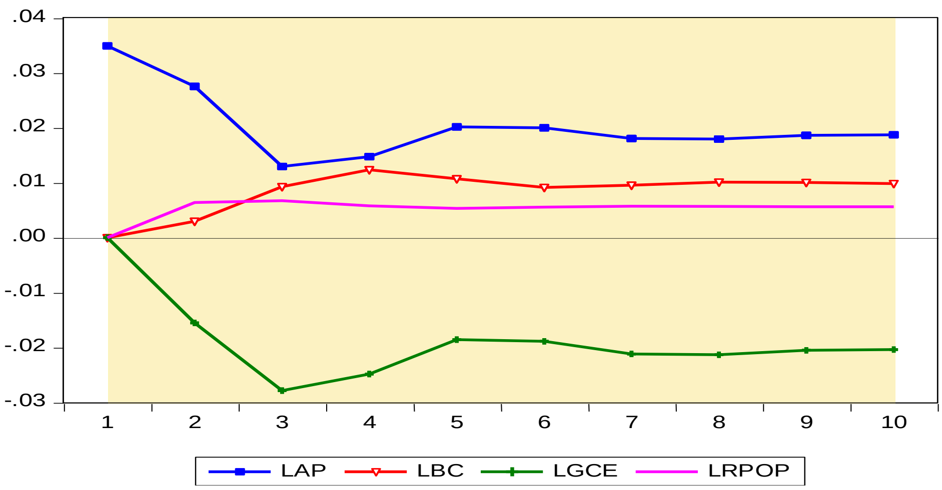
3.7. Model Efficiency Tests Results

In general, the model has no problems with serial correlation, homoskedasticity, normality test, and model stability, hence the model was feasible (see Table.8, figure .3, figure.4 on the appendix).

3.8. The Mechanisms of Impulse Response (IRFs).

In reaction to exogenous random shocks applied to this and other variables, impulse response functions (IRFs) indicate the dynamic properties of a variable which are given by its time path. As a result, it is easy to compare the model's predictions to those of economic theory.

Figure. 4. shows the LPA's Impulse Response Functions (IRFs) in response to a shock from a different variable.



In general, the shapes of the impulse response curves of agricultural productivity and bank credit were more or less similar in the long run. This verification, along with the Granger causality test and VECM in the long run, as well as the short run dynamic equation of our earlier verification.

3.9. The Decompositions of Variance (DV).

The proportion of a variable's movement caused by its own shocks as opposed to shocks in other variables in the system was revealed by the forecast error variance decomposition for each variable. In reality, whereas the DV offer the amplitude of the response to shocks, the impulse response function illustrates the direction of the dynamic response of the variables to various innovations.

Table 9: The decomposition of Variance

The decomposition Variance of LAP:				Variance Decomposition of LBC:		
Period	S.E.	LAP	LBC	S.E	LAP	LBC
1	0.034	100.000	0.000	0.212	2.937	97.063
2	0.048	87.193	0.394	0.321	4.920	91.351
10	0.098	46.407	8.619	0.716	4.369	88.748
15	0.119	43.782	9.346	0.878	4.336	88.553
20	0.136	42.430	9.727	1.012	4.318	88.456
25	0.152	41.602	9.961	1.131	4.308	88.398
30	0.166	41.04	10.119	1.239	4.301	88.359
35	0.179	40.640	10.233	1.338	4.296	88.331

Source: Calculated by the author using E-view 7

The major cause of variation in agricultural productivity was its own shocks with a 100% and 87.3% of the prediction error variance in one and two periods of the forecast horizon, correspondingly, which goes down to 40.6% in the thirty-five years. Similarly, the shock in LBC denotes the second cause for variation in the fluctuation of agricultural productivity, with 0.39 % for the projected second-year period . This share goes up 8.6%, 9.7%, and 10.1% variations of fluctuation in LAP within one, two, and three-decade horizons, respectively. The own innovation of agricultural productivity truly elucidated its variation in fluctuation both in the short-run and long-run as compared to shock in bank credit. In general, identification and analysis of variance decomposition has become in line with the Granger long-run ECM equation and impulse response function.

4. Conclusion

Motivated by the two scenarios, the researcher tried to empirically inspect the long-run causal association of agricultural productivity and bank credit in the country. To this effect, the researcher was employed the tools of multivariate time series analysis to control the dynamics of variables on yearly data for the Ethiopian fiscal years of 1981 to 2015 . According to the study's findings, agriculture productivity was positively and significantly influenced by bank credit which is reasonable and as expected in Ethiopia, and there is a unidirectional causation running from bank credit to agricultural productivity in the long-run which calls for practical intervention in the bank credit market. With only unidirectional causality, an inelastic bank credit coefficient (0.13), and a low power forecast of variance decomposition (10.1 for more than three decades), it is clear that small-holder farmers in particular, and agro-industrial based entrepreneurs in general, were excluded from bank credit in Ethiopia for a long time.

5. Policy Recommendation

The results from the study show that bank credit to the agriculture sector has a positive and significant impact on agricultural productivity in Ethiopia and that there is a unidirectional causation running from bank credit to agricultural productivity in the long run which calls for prudent intervention in the bank credit market. With only unidirectional causality, an inelastic bank credit coefficient (0.13), and a low power forecast of variance decomposition (10.1 for more than three decades), it is clear that small-holder farmers in particular, and agro-industrial based entrepreneurs in general, were excluded from bank credit in Ethiopia for a long time. A 1% permanent grow in agricultural bank credit would be expected to boost agricultural productivity by approximately 0.13% in the long run, which is relatively inelastic.

In effect of this:

The government should encourage public and private commercial banks in their attempt to propose special financing options adapted for agriculture sector since there is a long-run, positive, and significant association between the two sectors.

Agriculture stakeholders and policymakers must stand with particularly smallholder farmers and agri-entrepreneurs in general in their struggle to obtain agricultural loans from a bank.

Since there exist unidirectional causation from bank credit to agriculture productivity, the government and policy makers should have to propose the way in which a bidirectional causation created in order to strengthen the inter-linkages among the two sectors.

Lastly not least further studies should have to undertake by incorporating other related variables.

Declaration: I want to submit a research manuscript entitled Bank credit to agriculture sector and its productivity in Ethiopia for publishing in your esteemed journal. The author asserts that this manuscript is not given to another journal for recognition of any degree or diploma and I decided to send this document to the Journal of International Trade, Logistic and Law. The document has been organized as per the journal's rules and checked for grammar. Brief citations from this manuscript are endurable without special agreement if precise acknowledgment of the citation is made.

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Table 2: ECM long run and short run causality

Long run causality in ECM				
Dependent variable: LAP_{-1}	Null Ho: Lagged values of coefficient=0 Alt H1: Not zero			
Coefficient: ECM	Std. Error	t-Statistic	Probability	
-0.5151	0.1473	-3.4981	00.0017	
Dependent variable: LBC_{-1}	Std. Error	t-Statistic	Probability	
ECM: 0.793386	0.894854	0.8866	0.3834	
Short- run causality: Wald Test				
Independent variable	Dependent variable	hypothesis	Chi-square	prob
D(LBC_{-1})	D(LAP_{-1})	C(3)=0	0.746818	0.3875
D(LAP_{-1})	D(LBC_{-1})	C(9)=0	0.226556	0.6341

Table 3: Unrestricted co-integrating coefficients and speed of adjustment estimates

Cointegrating Eq:	LAP(-1)	LBC(-1)	LGCE(-1)	LRPOP(-1)	C
Eqn1	1.000000	0.1300 (0.041) [3.197]	-0.337 (0.08) [4.21]	1.582 (0.146) [10.80]	-13.97
Speed of adjustment					
D (LAP)	D(LBC)	D(LRP)	LGCE)		
-0.515106 (0.14725) [-3.49808]	0.7934 (0.895) [0.89]	0.0125 (0.019) [0.649]	-1.769 (0.62) [-2.85]		

Source: Author's Computation using Eviews 8 Note: Standard error in parentheses ( ) and t-statistics in [ ].

Table 4. Short run dynamics

	Coefficient	Std. Error	t-Statistic	Prob.
ECM_{-1}	-0.5151	0.1472	-3.498	0.0017**
$D(LAP_{-1})$	0.37374	0.2058	-1.816	0.081***
$D(LBC_{-1})$	-0.0271	0.0314	-0.864	0.395
$D(LGCE_{-1})$	0.08477	0.0411	2.060	0.049*
$D(LRP_{-1})$	0.8255	1.446	0.571	0.573
SBR	0.00072	0.01598	0.0451	0.9644
C	-0.004	0.016	-0.221	0.827

Source: own computation eview 8 *= at all significance, **= significant at 5% and ***= significant at 10

Table 8. Model Efficiency Test Results

Types of test	Null hypothesis(H0)	Chi-sq	probability
VEM residual serial correlation LM test	No serial correlation	0.14	0.275
VEM residual hetroskedasticity test	Residuals are multivariate normal	0.1351	0.1221

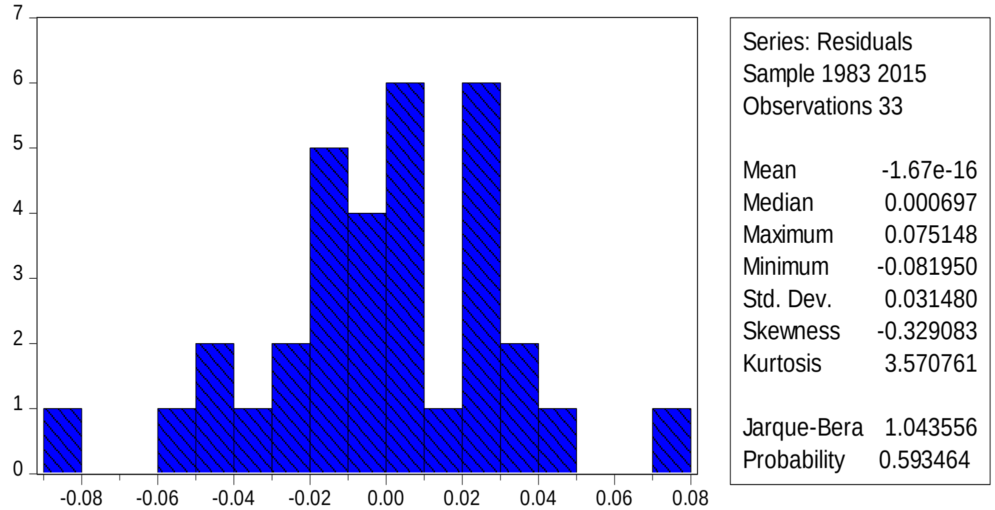

Figure. 5. Normality test of residual.

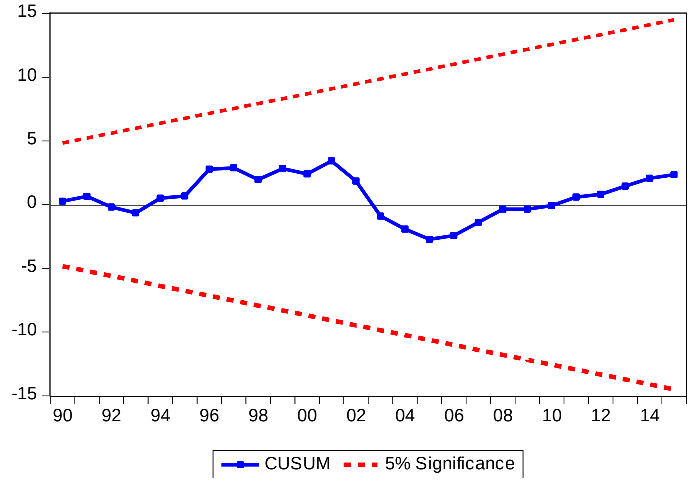

Figure. 6. Model stability CUSUM test