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The impact of commercial bank credit on agricultural sector output in Nigeria

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Abstract

The study studies the effect of commercial bank credit on agricultural sector output in Nigeria. The study uses time series data from 1986 G20 to 2024 G20 sourced from the Central Bank of Nigeria Statistical Bulletin and National Bureau of Statistics. In order to prevent the spurious regression result, stationarity properties of these time series data were investigated with Augmented Dickey-Fuller (ADF) test. The ADF results revealed that the variables were of different orders of integration, justifying the use of Auto-Regressive Distributed Lag (ARDL), as ARDL can be used when some series are integrated at I (0) and others at I (1). The results showed that they were positive and significant impact of Commercial Bank Credit to Agriculture (CBCA), Agricultural Credit Guarantee scheme (ACG) and lending interest rate on crop production output in Nigeria. Results further indicated that all three independent variables, commercial bank credit to agriculture, agricultural credit guarantee scheme and lending interest rate had positive and significant effective on animal production output. This, however, was not the case for commercial bank credit to agriculture, agricultural credit guarantee scheme and lending interest rate as all these target predictors did not have positive significant effect on the fishery production output in Nigeria. The study, however, concluded that policy implementation of mechanisms to enlarge agricultural credit and improve the sector's access to commercial bank credits in Nigeria; agricultural credit guarantee schemes be put in place in all the local government; and implementing concessionary interest rates on loans with regards to agriculture could lead a significant increase in output from this economically viable sector. It therefore recommended Agricultural Value Chain Finance (AVCF), an innovative approach for how to finance agriculture in Nigeria. AVCF deploys financial literacy trainings, savings, mechanized farming practices, budgeting and cash flow management to mitigate default risks and enhance the portfolio quality of agri-credit.

Keywords: *commercial bank credit, agricultural credit guarantee scheme fund, agricultural sector output.*

JEL: Code: Q14, G21, E24

1. Introduction

Agricultural sub-sector output in Nigeria has shown a downward trend in its contribution to Gross Domestic Product (GDP), export earnings and the economy's need since 1981, statistics showed that the monetary value of agricultural product imports in Nigeria increased from 959.51 billion naira to 1.1 trillion naira and to 2 trillion naira in 2019, 2020 and 2021 respectively, which is far above her exports of 270 billion naira, 321.5 billion naira and 504.9 billion naira in 2019, 2020 and 2021 respectively (Price Waterhouse Cooper PWR, 2022). Agricultural sector output is becoming relatively uncompetitive especially in relation to Asia and Latin America. Nigeria has therefore become heavily dependent on food importations. The impediment to adequate output in agricultural sub-sector is largely attributed to neglect as a result of the oil boom of the 1970s which manifested in small and primitive farming method, inadequate input and obsolete technology among others. As such, effort was made by the government to

correct this problem through concessional interest rates to farmers, credit guidelines that encourage commercial banks to lend to agricultural sub-sector and the establishing of Agricultural Credit Guarantee scheme (ACG). Consequently, Central Bank of Nigeria (CBN, 2021) reported that farmers have been benefiting from this credit incentive established to aid agricultural sector output.

In several nations, including Brazil and South Africa, banks' credit has worked brilliantly. Today, Brazil is a world producer of several agro-processed commodities. Its agriculture has improved due to credit from banks, better seeds, conservation of soil fertility, rise in technology adoption and backing of domestic and international research organisations (Okwuchukwu, 2022).

South Africa also exploits banks credit easy accessibility to become a market-oriented, productive and diverse agricultural economy. Hence, processing, preserving and value-added activities are relatively developed (International Trade Administration ITA, 2022). South African adopts best international standard agricultural practice. With mandatory annual hosting of harvest day symposium; the largest agricultural equipment show on the African continent that provides an opportunity for worldwide agricultural training, finance, equipment and technology exhibition. Thus, the use of agricultural machinery is well pronounced in South Africa's agricultural activities,

Agriculture plays a vital role in the economic development of many developing countries as it provides source of livelihood to a large number of households. Not only is agriculture a leading sector in developing economies but also the basis for development across all (Okpara, 2017). It feeds the escalating human population, which plays a role in food security and provides raw materials for manufacturing processes across other industrial sectors. Therefore, the agricultural sector has the potential to speed up the development and diversification by actively engaging in optimizing resources available locally while helping with less reliance on import driven agricultural goods and raw materials for national economic growth as well as sustainable development (Mathew & Mordecai, 2016).

Not more than 80% of Nigeria rural populace are involved in one form or the other of agricultural activity (Yusuf, Zakari, Alexander, Anthony & Alfa; 2022). In its first 10 years following independence, Nigeria resembled an agrarian economy where agriculture was once a large contributor of overall economic growth. The sector accounted for over 60% of the GDP of the country and supplied almost 90% of the total food needs, industrial raw materials, export earning etc (Mathew & Mordecai, 2016). Nevertheless, agriculture played a crucial role in Nigeria's economy and also supported food production for the population, however, this importance started slumping with the discovery of crude oil which led to lack of interest in agriculture due to over dependence on importing core food goods.

Effort was however made to strengthen the value chain mix and revolutionize agriculture as a business entity through enhanced commercial bank credit, since credit is recognized as an essential tool for promoting agricultural sector output (Egwu, 2016). These efforts by government through the central bank of Nigeria (CBN) include concessional interest rates and credit guidelines that encourage commercial banks to lend to agricultural sector. Consequently, Central Bank of Nigeria (CBN, 2021) reported that farmers have been benefiting from these credit incentives established to aid agricultural sector output. Commercial bank loan rose from 41.03 billion naira in 2000 to 128.41 billion naira in 2010 and 1,812.47 billion naira in 2022 (CBN 2022).

Yet, notwithstanding the potentials of these facilities to increase agricultural sub-sector output – Nigeria is endowed with some of nature's best human and natural resources capable for (feeding) food production across the West African sub-region, it has not really been impressive but continues to lose comparative advantage vis-a-vis other countries. During the pre-rebasing periods, average contribution of agricultural sector to GDP ranged from 26.51% (1993–2002) and 25.66% (2003–2012), compared with 22.09 % between2013-2022, indicating a decrease in agricultural output (CBN, 2022). The persistence of agro-based product –dominated import structure of Nigeria even with the increase in commercial bank credit to the agricultural sector is worrisome. Consequently, the objective of this study is to assess and determine the effects of commercial bank credit on crop production output in Nigeria; Identify the effect of commercial bank credit on animal production output, and Analyze the impact of commercial bank credit on fishery production output. The analysis will decompose agricultural production into 3 sectors–crop, animal and fishery productions–so that the effect of commercial bank credit on agriculture can be assessed for each sector individually. That represents a significant gap that the current study aims to fill.

2. Literature Review

2.1 Conceptual Review

The concept considered in this study are, the concept of commercial banks credit and the concept of agricultural sector output.

The Concept of Commercial Bank Credit

The concept of commercial banks credit as used in this study is defined as the provision of financial services

ranging from short, medium and long-term loans, and allocating such through commercial bank to the investors in the entire agricultural value chain, namely input supply, production, wholesaling, processing and marketing. These advances provide liquidity to farmers to buy input, prepare the farm land and to produce the goods to be sold.

The Concept of Agricultural Sector Output

The agricultural sector output in this work is defined as the whole monetary worth of the entire agricultural product produced by farmers to be consumed or used for future production at a certain period of time.

2.2 Theoretical Review

the theory adapted for this study are the theory of Solow Swan (1956) neo classical growth and Werner (1993) Quantity Theory of Credit.

One perspective is the neoclassical growth model: The availability and rational utilization of credit in an economy are crucial conditions for output increase (Solow, 1956; Swan, 1956). Additionally, the interaction of land, capital and labour determines economic output, while technological efficiency increases labour productivity capacity. It follows that credit plays an important part in production, as the availability of credit allows individuals and businesses to acquire other factors of production. In this line, Werner (1993) has a point where is Quantity Theory of Credit he argued that increases in nominal GDP could really only come from the volume growth of credit for production and other economic transactions thus neither reduction in interest rate, fiscal expansion nor reserve expansion are effective at stimulating it and also not structural reform. This means one must not see banks merely as passive financial intermediaries passing on existing money but rather dominant institutions that create new money in the process of lending.

We thus see, that both the neoclassical growth model of Solow (1956), Swan (1956) and Werner's (1993) Quantity Theory of Credit make a strong case for an important role of credit in stimulating output. Once access to cheap loans from commercial banks is available to more farmers, they are able to obtain the labour, inputs, equipment and technology needed to strengthen their production activities and boost output in agriculture. Hence, this study is grounded in these dual theories.

2.3 Literature Review

The relationship between bank loans and agriculture sector output has been investigated in many studies in the literature. The results of this research vary from one to another due to the variance in methodology, time frames, and factors represented in models.

Abugamea (2008) carried out a dynamic analysis of agricultural production determinants in Palestine, using Johansen Co-integration and Vector Error Correction (VEC) with variables such as commercial bank credit, agricultural productivity and agricultural labour. The study found that in the long-run, bank credit exerts an insignificant impact on agriculture productivity, but there exists a significant positive impact of labour force on agricultural production. Meanwhile, short-run dynamics showed that both bank credit and labour force were the main determinants of agricultural production in Palestine.

The need for providing agricultural credit to farmers is underscored by Shah, Jehanzeb and Khan (2008) in their analysis of the impact of agricultural credit on farm productivity in Pakistan, using the Quintile Regression (QR) and Stochastic Frontier Analysis Techniques (SFAT). Their study revealed that technology application of farmers increased tremendously because of access to credit and educational levels of farmers. The study further revealed that agricultural production was more positively affected by the formal credit than informal credit.

An investigation from an international perspective on agricultural sectors output growth by Derek, Mohammed and Prasad (2009) presented multi-output, multi-input and total factor productivity growth rates in the agricultural sectors for eighty-eight countries over the periods 1970-2001, estimated with both Stochastic Frontier Analysis (SFA) and the Data Envelopment Analysis (DEA). The central finding of the work is that policy and institutional variables, such as commercial bank credit and agricultural price policy reforms, were significantly correlated with total factor productivity growth in the agricultural sub-sector.

Magaji, Usman and Yusuf (2023) researched the evaluation of agricultural loan administration among selected commercial banks on agricultural output impact in Nigeria. A survey research design was adopted, using primary data collected through administering questionnaires to commercial banks and agricultural loan seekers from residents of the Federal Capital Territory, Abuja. Logit regression was then used to better understand how the responses of agricultural loan seekers and commercial banks were correlated. The results showed, among others, that agricultural loans from commercial banks positively influence the output of agriculture in Nigeria. Based on the study, it suggested the government provide some legislation that allows other low-cost funding channels like pension funds and housing scheme funds to be made accessible for commercial banks to borrow with lower costs and longer maturities so they can pass significant savings on to farmers.

In the same vein, Ajayi (2025) applied the dynamic

specification of Autoregressive Distributed Lag→ ARDL to investigate rub against anti-commercial bank credit and agricultural expand in Nigeria. Result 2: Positive insignificant effect of commercial bank credit and negative significant effect of interest rate on agricultural output growth The findings also documented a good and significant effect of commercial bank total assets on agricultural growth in the long run. In light of these results, the research proposed that commercial banks need to provide more loans to boost growth into the agricultural sector. The Government should formulate policies to bring interest rates on agricultural loans down to single digits, which will make loan repayments affordable and enable better access to agricultural credit – the blueprint stated.

3. Methodology

The analytical methods employed in this work include pre-analysis test such as unit root test and co-integration test. Also employed as a form of data analysis was the ARDL bound testing approach. The main advantage of ARDL approach is its adaptability that it can be used when the variables have different integration order.

The study employed time series secondary data on crop production output, animal production output and fishery production output as dependent variables while commercial bank credit to agriculture, agricultural credit guarantee scheme and lending interest rate were explanatory variables for Nigeria between 1986-2024. The data for this study were sourced from the Central Bank of Nigeria (CBN) statistical bulletin and National Bureau of Statistics publications in Nigeria.

3.1 Model Specification

The model and choice of variables in the model are specified based on Werner (1993) quantity theory of credit and in line with Egwu (2016) and Andahol & Abbah (2018) thus;

$$CPO = f(CBC, ACG, LIR) \quad 1$$

$$APO = f(CBC, ACG, LIR) \quad 2$$

$$FPO = f(CBC, ACG, LIR) \quad 3$$

Equation 1, 2 and 3 are transformed into its econometric form as follows.

$$CPO = a_o + a_1 CBC + a_2 ACG + a_3 LIR + U_t \quad 4$$

$$APO = a_o + a_1 CBC + a_2 ACG + a_3 LIR + U_t \quad 5$$

$$FPO = a_o + a_1 CBC + a_2 ACG + a_3 LIR + U_t \quad 6$$

Where:

CPO = Crop Production Output in Nigeria

APO = Animal Production Output in Nigeria

FPO = Fishery Production Output in Nigeria

CBC = Commercial Bank Credit to Agriculture

ACG = Agricultural Credit Guarantee scheme

LIR = Lending Interest Rate

t = time

U = Error Term

a_0 = intercept of the model

a_1, a_2 and a_3 = are coefficients of the explanatory variables.

Commercial bank credit to agriculture, agricultural credit guarantee are assumed to have positive and significant impact on crop production output, animal production output and fishery production output in Nigeria. While lending interest rate is expected to has an inverse but significant impact on crop production output, animal production output and fishery production output in Nigeria.

Estimation Technique

The Auto-Regressive Distributed Lag (ARDL) bounds testing approach as proposed by Pesaran, Shin and Smith (2001) were used in this study. The ARDL has few econometric strength benefits. First, such use aids in resolving endogeneity concerns and furthers testing of hypotheses regarding the coefficients of the longrun relationship. Second, the parameters of a model in both long and short runs can be estimated together. Third, ARDL approach has the notable advantage of being used regardless of the endogeneity of model variables. Fourth, ARDL is unique in the data-generating process when suitable lags can be included in a general-to-specific modelling framework.

Also, whereas some methods require that the variables in a time series regression are integrated of order zero 1(0), some require order one, I(1). Only ARDL test could be used regardless of whether the underlying variables are 1(0), I(1) or mixed or fractionally integrated. Therefore, the approach is considered to be very suitable for analysing the underlying relationship and has been increasingly used in empirical research in recent years. The equation specifying the conditional level relationship between the regressors and regressand is as follows

$$Yt = a_o + \delta_t + \theta_{xt} + \varepsilon t \quad 7$$

Where:

a_o is the intercept

δ_t is the short run response of the matrix polynomial

θ_{xt} is the vector of the conditional long run multiplier

εt is the error term.

The corresponding Unrestricted Error Correction Model (UECM) for Eq. (2) is as follows:

$$\mathrm{Yt} = \beta\mathrm{t} + \sum_{t=n}^{\mathrm{K}} Y\mathrm{t}-1\ \delta\mathrm{t} + \sum_{t=n}^{\mathrm{K}} X\mathrm{t}-1\ \theta\mathrm{t} + \varepsilon\mathrm{t} \qquad 8$$

Where;

Y and X are the variables of choice

β = vector of intercepts

δ_t and θ_t represent vector matrices that contain the short-run dynamic and long-run multipliers coefficients of the UECM respectively, εt is the error term. In this study equation (8) can be represented in the form of a linear error correction model (Pesaran, Shin & Smith, 2001) as follows;

$$\Delta\mathrm{CPO}_t\alpha_0 + \sum_{i=1}^{k}\alpha_{1i}\Delta\mathrm{CPO}_{t-1} + \sum_{i=1}^{k}\alpha_{2i}\Delta\mathrm{CBC}_{t-1} + \sum_{i=1}^{k}\alpha_{2i}\Delta\mathrm{ACG}_{t-1} + \sum_{i=1}^{k}\alpha_{3i}\Delta\mathrm{LIR}_{t-1} + \lambda_1 CPO_{t-1} + \lambda_2 CBC_{t-1} + \sum_{i=1}^{k}\alpha_{2i}\Delta\mathrm{ACG}_{t-1} + \lambda_3 LIR_{t-1} + \varepsilon_t \quad 9$$

$$\Delta\mathrm{APO}_t\alpha_0 + \sum_{i=1}^{k}\alpha_{1i}\Delta APO_{t-1} + \sum_{i=1}^{k}\alpha_{2i}\Delta\mathrm{CBC}_{t-1} + \sum_{i=1}^{k}\alpha_{2i}\Delta\mathrm{ACG}_{t-1} + \sum_{i=1}^{k}\alpha_{3i}\Delta\mathrm{LIR}_{t-1} + \lambda_1 APO_{t-1} + \lambda_2 CBC_{t-1} + \sum_{i=1}^{k}\alpha_{2i}\Delta\mathrm{ACG}_{t-1} + \lambda_3 LIR_{t-1} + \varepsilon_t \quad 10$$

$$\Delta\mathrm{FPO}_t\alpha_0 + \sum_{i=1}^{k}\alpha_{1i}\Delta\mathrm{FPO}_{t-1} + \sum_{i=1}^{k}\alpha_{2i}\Delta\mathrm{CBC}_{t-1} + \sum_{i=1}^{k}\alpha_{2i}\Delta\mathrm{ACG}_{t-1} + \sum_{i=1}^{k}\alpha_{3i}\Delta\mathrm{LIR}_{t-1} + \lambda_1 FPO_{t-1} + \lambda_2 CBC_{t-1} + \sum_{i=1}^{k}\alpha_{2i}\Delta\mathrm{ACG}_{t-1} + \lambda_3 LIR_{t-1} + \varepsilon_t \quad 11$$

Where;

Δ is difference operator

ε_t is assumed to be serially uncorrelated

α_1, $\alpha_2 \ldots \alpha_6$, and λ_1, λ_2 ....λ_6 represent the long-run and the short-run coefficients, respectively Besides, CPO, APO, FPO, CBC, ACG and LIR are variables already defined in equations (4), (5) and (6).

The data result of assessing the co-integration connection of the variables in the base equation 4, 5 and 6 respectively by subjecting equations (9), (10) and (11) to the data. The ARDL bounds test process is implemented in three steps. The first step is to test for co-integration relationship between the dependent and the independent variables. The null hypothesis (H0) will be evaluated against the alternative (H1) using the Wald test (F-statistics) of the combined significance of the lagged levels of the variable. The obtained F-statistic is then compared with the non-standard critical limits values as given in (Pesaran, Shin and Smith, 2001).

The hypothesis is accepted or rejected depending on comparison of the estimated F-statistic with the F-tabulated by Pesaran, Shin and Smith (2001) and for small samples by Narayan (2005). The F-tabulated has upper and lower bounds crucial values, if the calculated F statistic is larger than the upper boundaries value of F-tabulated then the null hypothesis is rejected and the alternative hypothesis is accepted that there is co-integration relationship between variables. However, if the calculated F-statistic is smaller than the lower bound value of F-tabulated, then the null hypothesis is accepted and the alternative hypothesis is rejected. This means that there is no co-integration relationship between the variables. But the test is inconclusive if the estimated F-statistic falls between the lower and upper bound critical values of F-tabulated. Having proven the co-integration, the next step is to estimate the long-run effect in equations (12), (13) and (14) as follows:

$$\lambda_i CPO_t = \lambda_1 CPO_{t-1} + \lambda_2 CBC_{t-1} + \lambda_2 ACG_{t-1} + \lambda_3 LIR_{t-1} + \varepsilon_t \qquad 12$$

$$\lambda_i APO_t = \lambda_1 APO_{t-1} + \lambda_2 CBC_{t-1} + \lambda_2 ACG_{t-1} + \lambda_3 LIR_{t-1} + \varepsilon_t \qquad 13$$

$$\lambda_i FPO_t = \lambda_1 FPO_{t-1} + \lambda_2 CBC_{t-1} + \lambda_2 ACG_{t-1} + \lambda_3 LIR_{t-1} + \varepsilon_t \qquad 14$$

The final step involves estimating an Error Correction Model (ECM) in Equations (15), (16) and (17) to obtain the short-run impact as specified below;

$$\Delta\mathrm{CPO}_t\alpha_0 + \sum_{i=1}^{k}\alpha_{1i}\Delta\mathrm{CPO}_{t-i} + \sum_{i=1}^{k}\alpha_{2i}\Delta\mathrm{CBC}_{t-i} + \sum_{i=1}^{k}\alpha_{3i}\Delta\mathrm{ACG}_{t-i} + \sum_{i=1}^{k}\alpha_{4i}\Delta\mathrm{LIR}_{t-i} + \delta ecm_{t-1} + \varepsilon_t \quad 15$$

$$\Delta\mathrm{APO}_t\alpha_0 + \sum_{i=1}^{k}\alpha_{1i}\Delta APO_{t-i} + \sum_{i=1}^{k}\alpha_{2i}\Delta\mathrm{CBC}_{t-i} + \sum_{i=1}^{k}\alpha_{3i}\Delta\mathrm{ACG}_{t-i} + \sum_{i=1}^{k}\alpha_{4i}\Delta\mathrm{LIR}_{t-i} + \delta ecm_{t-1} + \varepsilon_t \quad 16$$

$$\Delta\mathrm{FPO}_t\alpha_0 + \sum_{i=1}^{k}\alpha_{1i}\Delta\mathrm{FPO}_{t-i} + \sum_{i=1}^{k}\alpha_{2i}\Delta\mathrm{CBC}_{t-i} + \sum_{i=1}^{k}\alpha_{3i}\Delta\mathrm{ACG}_{t-i} + \sum_{i=1}^{k}\alpha_{4i}\Delta\mathrm{LIR}_{t-i} + \delta ecm_{t-1} + \varepsilon_t \quad 17$$

Where:

CPO, APO, FPO, CBC, ACG and LIR were variables previously defined in equation (4), (5) and (6), ecm_{t-1} = the error correction mechanism lagged for one period and δ = the coefficients for measuring speed of adjustment.

4. Discussion Of Result

Table 1: Unit Root Test Result using Augmented Dickey-Fuller

	T-statistic at level	P-value at level	T-statistic at 1st difference	P-value at 1st difference	Order of integration
LNCPO	-0.742701	0.8236	-5.868293	0.0000***	1(1)
LNAPO	-0.397816	0.8995	-4.397622	0.0012**	1(1)
LNFPO	-1.377739	0.5829	-6.842828	0.0000***	1(1)
LNCBC	-1.061587	0.7208	-6.900206	0.0000***	1(1)
LNACG	-1.242803	0.6453	-3.055213	0.0390**	1(1)
LIR	-3.889222	0.0049**	-8.254912	0.0000***	1(0)

Note: ***, **, and * imply significance at 1%, 5% and 10% respectively,

The unit root results indicate that all the variables are integrated of order 1, stationary after first difference, except for the loan interest rate which is stationary at level. This result justifies the use of ARDL limits approach to find out the co-integration, long run and short level correlations among the variables.

Co-integration Bound Test Result

Table 2: Co-integration Bound Test Result of Commercial Bank Credit and Crop Production Output in Nigeria

F-statistics	Lag	Alpha level	Bound Critical value	
5.355442	3		Lower Bound	Upper Bound
		1%	3.65	4.66
		5%	2.79	3.67
		10%	2.37	3.2

Source: Eviews

Table 3: Co-integration Bound Test Result of Commercial Bank Credit and Animal Production Output in Nigeria

F-statistics	Lag	Alpha level	Bound Critical value	
7.249162	3		Lower Bound	Upper Bound
		1%	3.65	4.66
		5%	2.79	3.67
		10%	2.37	3.2

Source: Eviews

Table 4: Co-integration Bound Test Result of Commercial Bank Credit and Fishery Production Output in Nigeria

F-statistics	Lag	Alpha level	Bound Critical value	
9.795545	3		Lower Bound	Upper Bound
		1%	3.65	4.66
		5%	2.79	3.67
		10%	2.37	3.2

Source: Eviews

Co-integration bound test result for equation 9, 10 and 11 shows The F-statistic for the models are 5.355442, 7.249162 and 9.795545 respectively which were greater than the upper critical bound value of 3.67 at the 5% significant level. This signifies that there existed a co-integration relationship among crop production output, animal production output fishery production output and it explanatory variables in Nigeria, thus rejecting the null hypothesis of no co-integration relationships amongst the variables. Since co-integration is established, the next steps involve estimating the short run and long run level relationship between the variables.

Table 5: Estimated Long Run Results of the Impact of Commercial Bank Credit on Crop Production Output in Nigeria

Dependent variable = LNCPO

Variable	Coefficient	SE	t-Statistic	P-value
CBC	0.001135	0.000387	2.929381	0.0075
LnACG	0.310425	0.022371	13.87598	0.0000
LIR	0.033344	0.017196	1.939074	0.0649

R-squared	0.894114	Mean dependent var	8.988979
Adjusted R-squared	0.791299	S.D. dependent var	0.668219
S.E. of regression	0.062330	Akaike info criterion	-2.446900
Sum squared resid	0.089354	Schwarz criterion	-1.913638
Log likelihood	54.82076	Hannan-Quinn criter.	-2.262818
F-statistic	353.1601	Durbin-Watson stat	2.530402

Source: Eviews

The long run result in Table 5 shows that the coefficient of commercial bank credit to agriculture is 0.001135. As such, it is positively related to crop production output in Nigeria in the long run. The value of 0.001135 implies that a 1% increase in commercial bank credit to agriculture resulted to 0.0011% increase in crop production output in the long run. In addition, it is statistically significant at 5% level given the probability value of 0.0075. The coefficient of agricultural credit guarantee scheme is correctly signed 0.310425 being positive, and statistically significant at 5% level. The coefficient of 0.310425 implies that a 1% increase in agricultural credit guarantee scheme leads to 0.31% increases in the crop production output in Nigeria in the long run. The coefficient of lending interest rate is positive at 0.033344 but statistically insignificant at 5% level, given the probability value of 0.0649.

Table 6: Short Run Results of the Commercial Bank Credit on Crop Production Output in Nigeria

Dependent variable = LNCPO

Variable	**Coefficient**	**SE**	**t-Statistic**	**P-value**
Intercept	1.284367	0.671103	1.913816	0.0682
ΔCBC	0.009000	0.000187	0.496398	0.6243
ΔlnACG	0.127882	0.062092	2.059557	0.0509
ΔLIR	0.011776	0.003582	3.287837	0.0032
CointEq(-1)*	-0.338848	0.047050	-7.201837	[0.0000]

Source: Eviews

Table 6 shows that the impact of Commercial Bank Credit (CBC) to agriculture on crop production output in Nigeria in the short run is statistically insignificant, given the probability value of 0.6243. Though the coefficient shows a positive relationship, however, the impact has not significantly improved crop production output in Nigeria. Furthermore, Agricultural Credit Guarantee (ACG) scheme has a positive coefficient of 0.127882, but has not significantly impacted crop production output in Nigeria since both the t-statistic and the probability value are statistically insignificant at 5% level. However, lending interest rate exhibited a positive and significant impact on

crop production output in Nigeria, with a probability value of 0.0032 and a coefficient of 0.011776. This implies that a 1% increase in the lending interest rate will result to 0.011% increase in crop production output in Nigeria in the short run.

Table 6 presents results of the short-term dynamics. The coefficient of the lagged error correction term (-0.338848) is negative and statistically significant at 5% level of significance. The negative and significant coefficient is evidence of co-integrating link between commercial bank credit to agriculture, agricultural credit guarantee plan, lending interest rate and crop production output in Nigeria. This magnitude shows that if there is any distortion, the long run equilibrium is corrected back where 33% of the disequilibrium in the previous year converges back to the equilibrium in the current year.

Table 7: Long Run Results of the Impact of Commercial Bank Credit and Animal Production Output in Nigeria Dependent variable = LNAPO

Variable	Coefficient	SE	t-Statistic	P-value
CBC	0.000393	0.000192	2.041582	0.0423
LnACG	0.231708	0.037560	6.169043	0.0000
LIR	-0.000300	0.007910	-0.004879	0.9961

R-squared	0.797298	Mean dependent var	6.653534
Adjusted R-squared	0.646173	S.D. dependent var	0.381189
S.E. of regression	0.023582	Akaike info criterion	-4.405400
Sum squared resid	0.013347	Schwarz criterion	-3.916576
Log likelihood	88.09450	Hannan-Quinn criter.	-4.236658
F-statistic	885.9910	Durbin-Watson stat	2.176385

Source: Eviews

The long run results in Table 7 shows that the coefficient of the impact of commercial bank loan on animal production output in the long run is appropriately signed (0.000393) and positive. It is also statistically significant at 5% level because of the probability value of 0.0423 which means that a 1% increase in commercial bank loan to agriculture leads to a 0.0003% rise in animal production output in Nigeria. The agricultural credit guarantee plan likewise had a positive (0.231708) and significant link with animal production output in Nigeria at probability value of 0.0000. The coefficient of 0.231708 implies that a 1% increase in the agricultural credit guarantee scheme will result to 0.231% increase in animal production output in Nigeria. However, the probability value of lending interest rate depicted in Table 7 is 0.9961 and the coefficient is negative -0.00300. This implies that the value has not significantly impacted animal production output in Nigeria.

Table 8: Short Run Results of the Impact of Commercial Bank Credit on Animal Production Output in Nigeria
Dependent variable = LNAPO

Variable	Coefficient	SE	t-Statistic	P-value
Intercept	0.610461	0.233133	2.618507	0.0151
ΔCBC	0.000103	7.10E-05	1.443530	0.1618
*Δ*lnACG	0.039608	0.009161	4.323342	0.0002
*Δ*IR	-0.0000006	0.001351	-0.004883	0.9961
CointEq (-1) *	-0.166401	0.021888	-7.602396	[0.00000]

Source: Eviews

The short run coefficient of the effect of commercial bank loan on animal production output is 0.000103 which is correctly signed but statistically insignificant at 5% level given the probability value of 0.1618 (Table 8). In addition, the coefficient and probability value of the agricultural credit guarantee scheme are 0.039608 and 0.0002, respectively, as shown in Table 8. Hence a 1% rise in agricultural credit guarantee scheme would raise animal production output by 0.039% in the short run. The probability value is substantial, which means there is a meaningful association between the two variables. This therefore suggests that agricultural credit guarantee plan

greatly enhanced animal production output in Nigeria in the short run.

The short run coefficient of loan interest rate is negative and statistically insignificant at 5% level, given the probability value of 0.6758, The results of the short run dynamics associated with the ARDL (1,0,1,0) are presented in Table 8. The coefficient of the lagged error correction term (-0.166401) is negative and significant at 5 percent level of significance. The negative and significant coefficient indicates co-integrating link among commercial bank credit to agriculture, agricultural credit guarantee plan, lending interest rate and animal production output in Nigeria. Size (-0.166401 means that any distortion the long run equilibrium is adjusted. Where around 16% of the disequilibrium in the previous year converges back to the equilibrium in the current year.

Table 9: Long Run Results of the Impact of Commercial Bank Credit on Fishery Production Output in Nigeria

Dependent variable = LNFPO

Variable	Coefficient	SE	t-Statistic	P-value
CBC	0.000345	0.000146	2.367795	0.0250
LnACG	0.238676	0.033028	7.226436	0.0000
LIR	-0.025340	0.032424	-0.781496	0.4411

R-squared	0.987780	Mean dependent var	5.224676
Adjusted R-squared	0.984289	S.D. dependent var	0.610854
S.E. of regression	0.076566	Akaike info criterion	-2.093541
Sum squared resid	0.164148	Schwarz criterion	-1.701696
Log likelihood	47.73051	Hannan-Quinn criter.	-1.955398
F-statistic	282.9239	Durbin-Watson stat	0.905762

Source: Eviews

The long run model in Table 9 reveals that the coefficient of Commercial Bank Credit (CBC) to agriculture is positive 0.000345 which implies that commercial bank credit to agricultural improves fishery production output in Nigeria. In the long run, a 1% increase in commercial bank lending to agriculture would improve fishing production output in Nigeria by 0.0003%. It is statistically significant at the probability value of 0.0250. This means that CBC can dramatically increases FPO in Nigeria in the long run.

Furthermore, the coefficient of agricultural credit guarantee program is 0.238676 that suggests a favourable link with the output of fishery production in Nigeria in the long run. Further, the effect is statistically significant with the probability value of 0.0000. Furthermore, the loan interest rate has a negative but minor link with agricultural production output in Nigeria with a probability value of 0.4411 and the coefficient of -0.025340.

Table 10: Short Run Results of the Impact of Commercial Bank Credit on Fishery Production Output in Nigeria

Dependent variable = LNFPO

Variable	Coefficient	SE	t-Statistic	P-value
Intercept	0.795728	0.199520	3.988219	0.0004
*Δ*CBC	0.000112	3.56E-05	3.144872	0.0039
*Δl*nACG	0.031623	0.059975	0.527276	0.6022
*Δ*LIR	-0.006076	0.004534	-1.340025	0.1910
CointEq(-1)*	-0.069955	0.013589	-5.148090	[0.0000]

Source: Eviews

The short run regression results obtained from the ARDL technique test in Table 10 show that, the coefficient of Commercial Bank Credit (CBC) to agriculture is 0.000112 correctly signed, being positive and statistically significant at 5% level given the probability value of 0.0039. The short run results reported in Table 10 indicated that a 1% increase in commercial bank credit to agriculture in the short run is associated with an approximate 0.0001% increase in Fishery Production Output (FPO) in Nigeria. This suggests that higher levels of commercial bank credit to agriculture are positively related to increased fishery production output in Nigeria in the short run.

The study also found that Agricultural Credit Guarantee scheme (ACG) had a coefficient of 0.031623; it is positively related to fishery production output in Nigeria in the short run. However, the impact is statistically insignificant at 5% level with a probability value of 0.6022. The coefficient of lending Interest Rate (LIR) was -0.006076, indicating an inverse relationship with fishery production output. In addition, the result is statistically insignificant with a probability value of 0.1910.

The results of the short-run dynamics associated with the ARDL (2,3,0,0) model are presented in Table 10. The coefficient of the lagged error correction term (-0.069955) is negative and statistically significant at the 5% level of significance. The negative and significant coefficient indicates the existence of a cointegrating relationship among commercial bank credit to agriculture, the Agricultural Credit Guarantee Scheme, lending interest rate, and fishery production output in Nigeria. The magnitude of the coefficient suggests that when a short-run distortion occurs, approximately 6.99% of the deviation from the long-run equilibrium is corrected each year, indicating a gradual adjustment towards long-run equilibrium.

Test of Hypotheses

In order to test the hypotheses 1 to 3 of this study, the study made use of the Wald Test probability values approach at 5% level of significance. The decision rule is stated thus: reject the null hypothesis if the probability value is less than 0.05, otherwise accept it. Wald Test statistic is use to ascertain a joint significant test of independent variables namely commercial bank credit to agriculture, agricultural credit guarantee scheme and lending interest rate on the dependent variables namely crop production output, animal production output and fishery production output in Nigeria.

Table 11: Wald Test Statistic

Probability value of the Wald Test statistic joint significant test of commercial bank credit, agricultural credit guarantee scheme and lending interest rate on crop production output in Nigeria

Test statistic	value	df	probability
F-statistic	9.608288	(2, 23)	0.0005

Probability value of the Wald Test statistic joint significant test of commercial bank credit, agricultural credit guarantee scheme and lending interest rate on animal production output in Nigeria

Test statistic	value	df	probability
F-statistic	5.493255	(2, 33)	0.0087

Probability value of the Wald Test statistic joint significant test of commercial bank credit, agricultural credit guarantee scheme and lending interest rate on fishery production output in Nigeria

Test statistic	value	df	probability
F-statistic	1.815193	(2, 27)	0.1821

Hypothesis One

The probability value obtained from the Wald Test statistic joint significant test of the impact of commercial bank credit, agricultural credit guarantee scheme and lending interest rate on crop production output in Nigeria is 0.0005.

Decision: The result reveals that probability value for the joint significant test of the influence of commercial bank credit, agricultural credit guarantee scheme and lending interest rate of the Wald Test statistic is less than 0.05 at 5% level of significance. Therefore, the study rejects the null hypothesis that commercial bank credit, agricultural credit guarantee scheme and lending interest rate have no impact on crop production output in Nigeria and accepts the alternative hypothesis that "commercial bank credit, agricultural credit guarantee scheme and lending interest rate have significant impact on crop production output in Nigeria".

Hypothesis Two

The result obtained from the Wald Test statistic joint significant test of the impact of commercial bank credit, agricultural credit guarantee scheme and lending interest rate on animal production output in Nigeria is 0.0087.

Decision: The p-value 0.0087, obtained using the Wald Test statistic joint significant test commercial bank credit (CBCA), agricultural credit guarantee scheme (ACGS) and lending interest rate (LINR) on animal production output in Nigeria are less than 0.05 level of significance i.e. Conclusions the results of the study therefore rejects the null hypothesis that commercial bank credit, agricultural credit guarantee scheme and lending interest rate does not significantly influence animal production output in Nigeria.

The hypotheses testing shows that, commercial bank credit, agricultural credit guarantee scheme and lending interest rate are the major factors that affect animal production output in Nigeria.

Hypothesis Three

The result obtained from the Wald Test statistic joint significant test of the impact of commercial bank credit, agricultural credit guarantee scheme and lending interest rate on fishery production output in Nigeria is 0.1821.

Decision: Since the probability value obtained from the Wald Test statistics joint significant test of the effect of commercial bank credit, agricultural credit guarantee scheme and lending interest rate on fishery production output in Nigeria is 0.1821, the study accepts the null hypothesis that commercial bank credit, agricultural credit guarantee scheme and lending interest rate have no significant effect on fishery production output in Nigeria and rejects the alternative hypothesis of commercial bank credit, agricultural credit guarantee scheme and lending interest rate have significant effect on fishery production output in Nigeria.

4.1 Discussion of Findings

The first objective of this study evaluated how commercial bank credit impacts crop production output in Nigeria. The result shows that commercial bank credit to agriculture is positively related with crop production output in Nigeria, and statistically significant, as such increase commercial bank credit is synonymous to increase crop production output in Nigeria. Similarly, Ilegbinosa, Sogules, and Itoro (2012) found evidence in support of the notion that commercial bank credit yielded positive impact but not large enough to turn around the fortunes of the crop production output due to lack of will by the commercial banks to channel their credit into the agricultural sector activities. Furthermore, the result obtained for the impact of agricultural credit guarantee scheme on crop production output in Nigeria revealed positive and significant relationship. This result conforms to the a priori expectation and lend credence to Anthony, Gabriel and Arikpo's (2015) study on the role of agricultural credit guarantee scheme in stimulating an increase in deposit money banks credit to the agricultural sub-sector in Nigeria. This result emphasizes the importance of government commitment to providing more credit schemes that could fund agriculture, so as to boost Nigeria agricultural output and enhance food security in the country. In addition, the significant impact revealed by this study between lending interest rate and crop production output agrees with Mathew and Mordecai (2016) who also found in their study that institutional lending rate had a significant impact on crop production output in Nigeria, and thus could be used to stimulate the growth of crop production output.

The second objective of the study investigated how commercial bank credit impact animal production output in Nigeria. The study found that commercial bank credit had positive and significant impact on animal production output in Nigeria. This shows that an increase in commercial bank credit has the potential to increase animal production output in Nigeria. In addition, the result extracted from the impact of agricultural credit guarantee scheme on animal production output in Nigeria also revealed a positive and significant relationship with animal production output in Nigeria. The significant impact shown in this study highlights the need for further intervention of both commercial bank credit and agricultural credit guarantee scheme in combating low yield in the animal production output. It thus implies that formal credit institutions have the capability to enhance high breed animal through increased funding for the sector, particularly in Nigeria where cattle rearing is prevalent. More so, the significant impact revealed in this study between lending interest rate and animal production output agree with Oluwasola and Alimi (2007) whose study postulated that concessionary borrowing cost could encourage business activities in animal production output to expand in Nigeria. They also noted that institutional lending rate has the potential to spur investment and growth in agricultural sector output in Nigeria.

The third objective of this study examined the effect of commercial bank loan on fishing production output in Nigeria. The result obtained from the joint significant test of the influence of commercial bank credit, agricultural credit guarantee scheme and lending interest rate using the Wald Test statistic demonstrates that these variables have joint inconsequential impact in fishery production output in Nigeria. The insignificant relationship implies that commercial bank credit to agriculture, agricultural credit guarantee scheme and lending interest rate channelled to the fishery sector were not sufficiently large to propel the fishery production output to the optimum desire level needed in Nigeria, and as such, this translated to lack of financial strength of farmers in Nigeria to acquire modern fishery production input. Fishery producing operations are largely small scale and are typified by subsistence farming (Okwuchukwu, 2022). This conclusion emphasises the complication involved in fisheries production output and hence warrants a critical re-evaluation of credit effort for better fishery production output in Nigeria and accentuates the need to customise credit to each particular component of agricultural sub-sector output.

4.2 Conclusion and Recommendation

The significant impact of commercial bank credit to agriculture, agricultural credit guarantee scheme and lending interest rate on the disaggregated agricultural sector output, namely crop production output and animal production output in Nigeria highlighted the unique importance of institutional credit in Nigeria. The significant outcome was an indicator that institutional credit if enhanced in Nigeria can meaningfully turn around the fortune of the agricultural sub-sector output performance, thus highlighting the need for further credit allocation to the agricultural sub-sector. However, the result found an insignificant relationship between commercial bank credit to agriculture, agricultural credit guarantee scheme, lending interest rate and fishery production output in Nigeria.

The following recommendations are made on the basis and strength of the findings of the study so as to achieve sustainable agricultural sector output growth in Nigeria.

1 There is need for commercial banks in Nigeria to adopt Agricultural Value Chain Finance (VCF) as one of the innovative ways of financing agriculture. AVCF incorporates financial literacy training programs that educate agricultural value chain actors as farmers are taught some important topics like savings, budgeting and cash flow management to help minimize default risk and improve the quality of agricultural loan portfolios.

2 In an effort to further enhance the link between Agricultural Credit Guarantee (ACG) scheme and agricultural sector operations in Nigeria, there is the need for the management board of ACG to add flexibility into repayment plans. In addition, the majority of the farmers live in rural locations and have no touch with the traditional banking institutions. It would, therefore, be timely to establish branches or units in all the local government areas of Nigeria that would sensitise the farmers on how to access the credit and its potential benefit. Greater access to information on these schemes and its potential benefit to the rural farmers is very critical to the viability of ACG and accelerated growth in agricultural sector output in Nigeria.

3 It is very urgent for the Central Bank of Nigeria to further improve on the monetary policies that provide farmers with interest rate that is free from investment bottle-necks so as to encourage potential local and international investors in the agriculture sector. The increasing trend in the country's spending for the importation of agricultural product should be discourage. As such, farmer-centered policies that will suit agricultural sector that provide concessionary interest rate in agricultural sector is timely. This would help guarantee investors' returns both in the long run and short run.

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Appendix 1

ARDL Long Run Form and Bounds Test
Dependent Variable: DLOG(CPO)
Selected Model: ARDL(1, 4, 3, 0)
Case 2: Restricted Constant and No Trend
Date: 09/23/25 Time: 15:59
Sample: 1986 2024
Included observations: 35

Conditional Error Correction Regression

Variable	Coefficient	Std. Error	t-Statistic	Prob.
C	1.284367	0.671103	1.913816	0.0682
LOG(CPO(-1))*	-0.353155	0.143738	-2.456929	0.0220
CBC(-1)	0.000401	0.000174	2.300413	0.0308
LOG(ACG(-1))	0.109628	0.043841	2.500600	0.0200
LIR**	0.011776	0.003582	3.287837	0.0032
D(CBC)	0.009000	0.000187	0.496398	0.6243
D(CBC(-1))	-0.000485	0.000255	-1.902584	0.0697
D(CBC(-2))	-0.000890	0.000369	-2.413910	0.0241
D(CBC(-3))	-0.000676	0.000364	-1.859807	0.0758
DLOG(ACG)	0.127882	0.062092	2.059557	0.0509
DLOG(ACG(-1))	0.069625	0.064204	1.084436	0.2894
DLOG(ACG(-2))	0.107541	0.060346	1.782068	0.0879

* p-value incompatible with t-Bounds distribution.
** Variable interpreted as Z = Z(-1) + D(Z).

Levels Equation
Case 2: Restricted Constant and No Trend

Variable	Coefficient	Std. Error	t-Statistic	Prob.
CBC	0.001135	0.000387	2.929381	0.0075
LOG(ACG)	0.310425	0.022371	13.87598	0.0000
LIR	0.033344	0.017196	1.939074	0.0649
C	3.636834	0.566321	6.421865	0.0000

EC = LOG(CPO) - (0.0011*CBC + 0.3104*LOG(ACG) + 0.0333*LIR + 3.6368)

F-Bounds Test — Null Hypothesis: No levels relationship

Test Statistic	Value	Signif.	I(0)	I(1)
			Asymptotic: n=1000	
F-statistic	5.355442	10%	2.37	3.2
K	3	5%	2.79	3.67
		2.5%	3.15	4.08
		1%	3.65	4.66
Actual Sample Size	35		Finite Sample: n=35	
		10%	2.618	3.532
		5%	3.164	4.194
		1%	4.428	5.816

ARDL Long Run Form and Bounds Test
Dependent Variable: DLOG(APO)
Selected Model: ARDL(4, 3, 0, 0)
Case 2: Restricted Constant and No Trend
Date: 09/23/25 Time: 16:14
Sample: 1986 2024
Included observations: 35

Conditional Error Correction Regression

Variable	Coefficient	Std. Error	t-Statistic	Prob.
C	0.610461	0.233133	2.618507	0.0151
LOG(APO(-1))*	-0.170940	0.054693	-3.125472	0.0046
CBC(-1)	6.71E-05	4.09E-05	1.640219	0.1140
LOG(ACG)**	0.039608	0.009161	4.323342	0.0002
LIR**	-6.60E-06	0.001351	-0.004883	0.9961
DLOG(APO(-1))	-0.320987	0.218843	-1.466750	0.1554
DLOG(APO(-2))	0.183346	0.276434	0.663252	0.5135
DLOG(APO(-3))	-0.444864	0.252813	-1.759654	0.0912
D(CBC)	0.000103	7.10E-05	1.443530	0.1618
D(CBC(-1))	-0.000314	8.62E-05	-3.646993	0.0013
D(CBC(-2))	-0.000198	0.000121	-1.642872	0.1134

* p-value incompatible with t-Bounds distribution.
** Variable interpreted as Z = Z(-1) + D(Z).

Levels Equation
Case 2: Restricted Constant and No Trend

Variable	Coefficient	Std. Error	t-Statistic	Prob.
CBC	0.000393	0.000192	2.041582	0.0423

LOG(ACG)	0.231708	0.037560	6.169043	0.0000
LIR	-3.86E-03	0.007910	-0.004879	0.9961
C	3.571194	0.400585	8.914948	0.0000

EC = LOG(APO) - (0.0004*CBC + 0.2317*LOG(ACG) -0.0000*LIR + 3.5712)

F-Bounds Test — Null Hypothesis: No levels relationship

Test Statistic	Value	Signif.	I(0)	I(1)
			Asymptotic: n=1000	
F-statistic	7.249162	10%	2.37	3.2
K	3	5%	2.79	3.67
		2.5%	3.15	4.08
		1%	3.65	4.66
Actual Sample Size	35		Finite Sample: n=35	
		10%	2.618	3.532
		5%	3.164	4.194
		1%	4.428	5.816

ARDL Long Run Form and Bounds Test
Dependent Variable: DLOG(FPO)
Selected Model: ARDL(2, 0, 1, 2)
Case 2: Restricted Constant and No Trend
Date: 09/23/25 Time: 16:27
Sample: 1986 2024
Included observations: 37

Conditional Error Correction Regression

Variable	Coefficient	Std. Error	t-Statistic	Prob.
C	0.795728	0.199520	3.988219	0.0004
LOG(FPO(-1))*	-0.325056	0.108283	-3.001901	0.0056
CBC**	0.000112	3.56E-05	3.144872	0.0039
LOG(ACG(-1))	0.077583	0.033363	2.325433	0.0275
LIR(-1)	-0.008237	0.008217	-1.002362	0.3248
DLOG(FPO(-1))	0.339290	0.132201	2.566478	0.0159
DLOG(ACG)	0.031623	0.059975	0.527276	0.6022
D(LIR)	-0.006076	0.004534	-1.340025	0.1910
D(LIR(-1))	-0.002464	0.003928	-0.627188	0.5356

* p-value incompatible with t-Bounds distribution.
** Variable interpreted as Z = Z(-1) + D(Z).

Levels Equation
Case 2: Restricted Constant and No Trend

Variable	Coefficient	Std. Error	t-Statistic	Prob.
CBC	0.000345	0.000146	2.367795	0.0250
LOG(ACG)	0.238676	0.033028	7.226436	0.0000
LIR	-0.025340	0.032424	-0.781496	0.4411
C	2.447973	1.162274	2.106192	0.0443

EC = LOG(FPO) - (0.0003*CBC + 0.2387*LOG(ACG) -0.0253*LIR + 2.4480)

F-Bounds Test | Null Hypothesis: No levels relationship

Test Statistic	Value	Signif.	I(0)	I(1)
			Asymptotic: n=1000	
F-statistic	9.795545	10%	2.37	3.2
K	3	5%	2.79	3.67
		2.5%	3.15	4.08
		1%	3.65	4.66
Actual Sample Size	37		Finite Sample: n=40	
		10%	2.592	3.454
		5%	3.1	4.088
		1%	4.31	5.544
			Finite Sample: n=35	
		10%	2.618	3.532
		5%	3.164	4.194
		1%	4.428	5.816