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HIGHER DERIVATIVE BLOCK METHOD FORECAST ANALYSIS OF AGRICULTURAL COMPONENTS AND THEIR IMPACT ON ECONOMIC GROWTH

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Abstract

This article assesses specific components of the agricultural sector as it impacts the growth of a developing nation's economy. A mathematical model is developed with the aid of logistic growth model for the variables and the resulting model is solved numerically using a higher derivative block method to forecast the data for the agricultural components for years 2020-2025, thus utilizing data ranging from 1981-2025. Econometric analysis was carried out using ARDL bound test method and the findings indicate the existence of short and long run relationship between food production, livestock, and economic growth. In addition, the Pairwise Granger causality showed the causality movement and ascertain the positive link among the variables. Therefore, this research suggests the need to encourage food production and livestock as components of agriculture through precise economic policies and funding for progress in the country's economic outlook.

Keywords: *Food production, livestock, economic growth, growth model, numerical analysis, econometric models.*
JEL Code: *B41, C01, C02, C53, E27*

1. Introduction

The global impact of agricultural business cannot be overemphasized as it is the exigent monetary turn of progress and expansion. The agrarian sector being the wellspring of livelihood to some countries and provider of natural substances to businesses in other countries, fuels huge commitment and improvement in economic monetary and fiscal development. Hence, agriculture can be view as the spine of most nations' economies like Nigeria (Azam & Shafique, 2017; Bukhtiarova et al., 2019; Fukase & Martin, 2020; Mehta & Patel, 2020). In view of this, various investigations have been implemented to assess the impacts of macroeconomic factors on economy development. In different countries, critical exploration endeavors have been made by researchers to analyze various factors connecting with agribusiness on economy development and advancement as seen in studies by Azam and Shafique (2017), Sertoglu et al. (2017), Ewetan et al. (2017), Gyulgyulyan and Bobojonov (2019), Qiao et al. (2019), Wang and Jiang (2019), Palma and Reis (2019), McArthur and Sachs (2019), Kumar and Gopalsamy (2019), Manap and Ismail (2019), Khan et al. (2019), Mehta and Patel (2020), and Sui and Lv (2021).

These studies focused on featuring the indispensable contributions played by farming as urgent area to the economies. For instance, the study by Khan et al. (2019) discussed about the advantages of farming in invigorating monetary development in India. It was expressed by the authors that financial analysts have contended that farming is essential for advancement and contributes monetarily to a country's economy. The study revealed how agribusiness has added to West Bengal's financial greatness using experimental information and cointegration examination. Also in India, Mehta and Patel (2020) explored whether farming creation matters for monetary development by conducting a contextual investigation for the period 1961 to 2016. The review used the Johansen co-incorporation and vector blunder rectification (VEC) strategies for examining the association between agrarian creation and monetary development. The outcomes showed that for quite some time, there is run connection between the factors inspected, and furthermore demonstrated that there is unidirectional causality running from monetary development to agribusiness creation over the long haul, implying that financial development prompts agribusiness. It was additionally referenced that bidirectional causality was found in the short run, showing that monetary development prompts agrarian creation and versus. Additionally, Azam and Shafique (2017) expressed that agribusiness is viewed as the foundation of any economy and it is likewise the main area of Pakistan's economy. The exploration examined the effect of Pakistan's farming on its economy, and the rural difficulties and its potential arrangements was likewise featured in the study. A few agribusiness issues were identified which includes restricted water, helpless administration, and regular cataclysms, which contrarily affect Pakistan's economy with evident changes in Pakistan's financial development (GDP).

Nigeria, also being a developing country as the countries assessed above, is at-heart or characteristically an agrarian country, as 35% of the general public is transversely and forthrightly connected to agribusiness area notwithstanding the pandemic occurrence contrasted with 70% in earlier year. The commitment of agribusiness in 2020 to GDP is around 24.14% and it utilizes 34.9% of the workforce (total occupation) in 2019. Nigeria's total development part is around 70.8 million hectares (77.7% of land regions), and 34-million-hectare (37.3% of land regions) region is under development, demonstrating that the greater segment of development region is inactive and unused. Accordingly, this area can in any case be portrayed as the main area of the Nigeria economy, which holds a great deal of capabilities for the future financial advancement of the country as recorded in different examinations (Oyetade & Adeyeye, 2021; Inusa et al., 2018; Central Bank of Nigeria, 2021). Based on these properties, researchers have grown interest in assessing agriculture and its impact on the Nigerian economy. Sertoglu et al. (2017) conducted a study in Nigeria expressing that agribusiness is a panacea for financial development. The authors observationally inspected the effect of agrarian area on the monetary development of Nigeria, utilizing time series information from 1981 to 2013. Their discoveries uncovered that agrarian result emphatically affected monetary development. It was suggested that the public authority and strategy producers ought to leave on expansion and improve more distribution as far as planning to the farming area. Similarly, Ewetan et al. (2017) also suggested that the public authority in Nigeria ought to additionally reinforce horticultural approaches in the space of financing, storage spaces, and market admittance to upgrade agrarian creation. This is from the findings from the analysis conducted for the period 1981 to 2014 utilizing time series information.

With different studies taking into consideration the connection between multifarious macroeconomic factors such as agriculture and economic development or growth, this study is exceptionally desirable as it assesses a nation's unique situation with respect to long period agricultural policies for sustainable growth. Thus, this research therefore provide answers to these questions on what can be the effect of the components of agriculture to Nigeria's economic growth in future and is there direction of any causality between the variables?

2. Theoretical Frameork

The evolution from the Lewis model, dual sector model, human capital theory and the input-output analysis provides the detailed or comprehensive understanding of how different facets of agriculture contributes to economic growth and development of nations. These theories among others are part of the various theories that reveals the linkage of agriculture to countires‘ growth. This is by the involvement of the agricultural advancement as a drive of overall economic growth and development by the theories. The Lewis model proposed and assumed that changes in labour in agriculture (surplus labour) will transferred or led to changes in other sectors, hence fostering or promoting industrialization and economic growth. The dual sector model advances this theory (Lewis model) by presuming that the co-existence of a traditional - agricultural sector and a modern – industrial sector are important for sustained economic development and growth.

However, human capital theory emphasizes on the role of education and skill development in agriculture. The theory asserts that investing in human capital within the agricultural sector can enhance productivity and contribute to broaden economics growth. This is similar to the rural -urban linkages that shows a vibrant agricultural sector can stimulate rural economies thereby leading to increased in demand for goods and services and influencing overall economic growth. Considering the input-output analysis the approach exhibit the interdependence of different sectors in highlighting how improvement in agriculture can have multiplier effects on other industries thereby fostering growth.

Going by these theoretical frameworks that collectively underscore the intricate relationship between agriculture and economic growth, likewise similar works conducted by Sertoglu et al. (2017), Ewetan et al. (2017), Palma and Reis (2019), McArthur and Sachs (2019), Kumar and Gopalsamy (2019), Khan et al. (2019), Mehta and Patel (2020), Sui and Lv (2021), and Oyetade and Adeyeye (2021); the following model is therefore specified in order to examine the empirical relationship of the components of agriculture on economic growth.

This is achieved by individual examination of the agricultural sector’s components. In agreement to this statement, the concentration of this study however elucidate the fundamental parts all-encompassing the agrarian area independently on financial development in Nigeria to identify the exact component(s) that influence economic growth. This research has however extended the data coverage beyond the level available in the extant literatures by introduces a different method (two-step higher derivative block method) of predicting or forecasting data of the selected variables that will be analyzed. This is to contend with current realities and depicts future on the relationship between the variables in Nigeria. Thus, there is need to analysis whether there is existence of long run relationship among the variables.

3. Methodology

This study encompasses quantitative investigation of the agricultural components using numerical and econometric analysis as detailed in this section. The first step is to develop the required model for the study. The model of this study is adopted based on the hypothetical and empirical models. Thus, the generalized growth model by Solow (1956), comparative with the neo-classical total production expression as the hypothetical reinforcement of the outcome condition, is introduced as follows:

$$GP_t = A_t f(K_t, L_t) \tag{1}$$

where "*GP"* signifies total output, "*A"* is the level of technology, "*K"* is actual capital with the consideration of human resources concerning the neo-classical total production capacity, and "*L"* indicates work as in Solow's model. Following Feder's model augmentation of the output function in an economy comprises of both the trade or export (T) and non-trade (N) sectors (Feder, 1982), with each of the sectors having different production capacities with the integration of *A*, *K* and *L* as components affecting outcome. This implies that

$$GP_t = A_t f(K_t, L_t, N_t) \tag{2}$$

In accordance with Equation 2, the farming area is presented as a non-trade area. Consequently, to accomplish the analysis's aim, which is to look at the impact of every part of farming product (fishery, food Production, forestry & livestock) on financial growth, the global growth function is adjusted. The linear model for the goal to be accomplished is accordingly characterized as:

$$Y_t = \lambda_0 + \lambda_1 Fis_t + \lambda_2 FP_t + \lambda_3 For_t + \lambda_4 Liv_t + \mu_t, \tag{3}$$

with corresponding ARDL representation given as:

$$\Delta \mathrm{Y}_t = \lambda_0 + \sum_{i=1}^{n} \lambda_{1i} \Delta \mathrm{Y}_{t-i} + \sum_{i=1}^{n} \alpha_{2i} \Delta \mathrm{Fis}_{t-i} + \sum_{i=1}^{n} \alpha_{2i} \Delta \mathrm{FP}_{t-i} + \sum_{i=1}^{n} \alpha_{2i} \Delta \mathrm{For}_{t-i} + \sum_{i=1}^{n} \alpha_{2i} \Delta \mathrm{Liv}_{t-i} + e_t \tag{4}$$

where

$Y_t = GP$,

$\{Fis_t, FP_t, For_t, \&Liv_t\} = \{Fishery, Food\ Production, Forestry, Livestock\}$,

$\{\lambda_0, \lambda_1, \lambda_2, \lambda_3, \lambda_4, \alpha_2, \sigma_2\}$ are parameters, and e_t represents the error term.

The data required for the analysis in this article spans from 1981-2025, however the data for 2020-2025 was obtained using an introduction of a new method (two-step higher derivative block method), instead of the Box-Jenkins method (Autoregressive Integrated Moving Average -ARIMA), exponential smoothing and state-space models mostly used for forecasting in time series analysis. While the initial data is obtained from Central Bank Nigeria (CBN) Statistical Bulletin, 2020. The dataset expanded for this period (2020 -2025) is for enhancing the predictive perforemance of how this sector's components will affect the nation's economic growth. In order to aid in planning for future, each variable data was predicted. Thus, the logistic growth model is defined as

$$\Psi' = r\Psi\left(1 - \frac{\Psi}{\Gamma}\right), \Psi(t_0) = \Psi_0 \tag{5}$$

where $\Psi' = f(\Psi, t)$, $\Psi(t)$ represents the variable value as a function of time *t*, the constant Ψ_0 denotes the initialized value at a chosen time *t*, Γ denotes the carrying capacity (limiting value) of the variables, and *r* represents the growth rate. The usuability of the logistic growth model is affirmed by its adoption in Rahim and Zikri (2019), hence its implementation in this article.

To develop the higher derivative block method, a linear block approach is adopted following the expression

$$\begin{aligned} \Psi_{n+1} - \Psi_n - \textstyle\sum_{i=0}^{2}\left(\phi_{i1}\Psi_{n+i}^{(1)} + \tau_{i1}\Psi_{n+i}^{(2)}\right) = 0 \\ \Psi_{n+2} - \Psi_n - \textstyle\sum_{i=0}^{2}\left(\phi_{i2}\Psi_{n+i}^{(1)} + \tau_{i2}\Psi_{n+i}^{(2)}\right) = 0 \end{aligned} \tag{6}$$

The values of the coefficients $\emptyset_{01}$, $\emptyset_{11}$, $\emptyset_{21}$, τ_{01}, τ_{11}, τ_{21}, $\emptyset_{02}$, $\emptyset_{12}$, $\emptyset_{22}$, τ_{02}, τ_{12}, and τ_{22} are obtained using a similar approach by Adeyeye and Omar (2018). Thus, the resulting two-step higher derivative block method is derived as

$$\Psi_{n+1} - \Psi_n - \frac{h}{240}\left[101\Psi_n^{(1)} + 128\Psi_{n+1}^{(1)} + 11\Psi_{n+2}^{(1)} + h\left(13\Psi_n^{(2)} - 40\Psi_{n+1}^{(2)} - 3\Psi_{n+2}^{(2)}\right)\right] = 0$$
$$\Psi_{n+2} - \Psi_n - \frac{h}{15}\left[7\Psi_n^{(1)} + 16\Psi_{n+1}^{(1)} + 7\Psi_{n+2}^{(1)} + h\left(\Psi_n^{(2)} - \Psi_{n+2}^{(2)}\right)\right] = 0 \quad (7)$$

In order to ensure the usability of the higher derivative block method, its convergence property is investigated. The block method schemes in Equation (7) is said to be convergent is it is zero-stable and consist. For the zero-stability condition, the roots of its first characteristic polynomial $r^2 - r$ satisfies $|r| \leq 1$, and in terms of consistency, the order of the method which is 6 satisfies the condition to be greater than or equal to 1. Therefore, since the block method satisfies both conditions of zero-stability and consistency, it is convergent.

After establishing the usability of the higher derivative block method, it is utilized for the numerical solution of Equation (5) such that the iteration is initialized at $t_0 = 2017$. The schemes are combined as simultaneous integrators for the solution of Equation (5) with the condition $\left|\Psi_{t(computed)} - \Psi_{t(exact)}\right| \to 0$ imposed for accuracy, where $\Psi_{t(exact)}$ is extracted from the dataset. The resulting predictions were then utilized for the next phase of the methodology which is the empirical analysis of the data.

4. Results and Discussion

The econometric model is utilized to examine the connection between GDP as a reliant variable and the parts of agricultural product that are considered as the explanatory factors. Precisely, this research characterizes the theories in accordance with the expressed models to accomplish the objective, which is whether the parts of farming product (fishery, food production, livestock, and forestry) would essentially affect the country's gross domestic product (GDP) in short and long time run for the analyzed time period.

Time Series Stationary Test

This section begins with the stationary test. The unit root test is conducted for the time series information to really take a look at the factor's stationary nature; at level, first difference or second difference that are destined as I (0), I (1) and I (2) exclusively. In this way, assuming the factors of a model have mixed stationarity results that is displaying a variable at I (0) and others at I (1), then, at that point, the ARDL assessment technique can be adopted. This co-integration investigation created by Pesaran and Shin (1998) is relevant on the grounds that it examines factors regardless of the stationarity. However, factors principally at I (0) or I (1) are utilized for the assessment and recognizable proof of long run and short-run changes of the autonomous variable(s) on the dependent variable through the guide of the bound test and error correction model (Gujarati, 1995). The Augmented Dickey Fuller (ADF) and Philips-Perron (PP) tests are utilized for pointing out the integration order (stationarity test) as shown in Table 1 below.

Table 1. ADF and PP Unit Root Test

Variable	ADF		PP		Result
	Constant	Trend and Constant	Constant	Trend and Constant	
Fis	3.587592***	3.754604***	3.594638***	3.789733***	I (1)
FP	5.421605***	5.798123***	5.468606***	5.804423***	I (1)
For	5.270435***	6.664915***	5.309020***	6.675620***	I (1)
Liv	3.245049**	3.207412*	3.194809**	3.201875*	I (1)
GDP	3.269512**	2.937720	4.421770***	4.191807***	I (0)

Source: Computation by Authors based on outcome in EViews 11
Notes: ***, **, * indicates dismissal of the invalid speculation of a unit root at the 1%, 5%, and 10% centrality level respectively. No reference mark shows that the arrangement is non-stationary.

As indicated in Table 1, the stationarity test disclosed that ADF and PP are both at level I (0) and first disparities I (1) for the factors studied. This conjectures that in line with the two techniques for unit root tests (ADF and PP), it is presumed that the factors (GDP, fishery, forestry, food production, and livestock) analyzed for the nation are fixed at I (0) and I (1). Thus, the outcome support continuing with the ARDL co-integration test that oblige stationarity of factors at I (0) and I (1) for additional investigation.

Cointegration Test (Bound Test)

Thereafter, the bound test is conducted. This test introduced by Pesaran, Shin and Smith, (2001) lays out the presence of the long run relationship among the factors and furthermore reflects presence of error remedy. Considering the dataset, an Autoregressive distributed lag (ARDL) (2, 3, 3, 4, 2) measurement was picked for the model with unadjusted R (86.6%) and the changed R (75.7%). Along these lines, the assessment of 'F' statistics for the ARDL estimate for GDP with the agrarian outcome is given in Table 2. This table also reveals the fitting optimal lag length that prompts reasonable cointegration outcome as indicated by Akaike Info Criterion (AIC). .

Table 2. ARDL Estimate

Selected Model: ARDL (2, 3, 3, 4, 2)			
R-Squared	0.866311	Adjusted R-Squared	0.756929
F-Statistic	7.920053	Prob.(F-Statistic)	0.000007

Source: Computation by Authors based on outcome in EViews 11.

It is detectable from Table 3 that the invalid conjecture of no cointegration is dismissed, and the presence of long run congruity is attested. The concluding piece of the cointegration is gotten from Narayan (2005) essential table for the diverse autonomous factors (k = 4), and number of perceptions (n = 41) for lower and upper points at 1% and 5% criticality dimension. It is seen that GDP is co-incorporated with fishery, forestry, food production and livestock. This infers that there is for quite a long run connection among GDP and the parts of agriculture so the null hypothesis is rejected. Thus, in line with assumption of long run relationship variables expectation of stability (constancy) without any systematic upward and downward trend the case of restrristed intercept or constant with no trend is most applicable to this study. Hence, the cointegration between the variables aid the short and long run analysis of the dynamics factors influencing Nigeria's GDP in term of agricultural sector.

Table 3. Result of ARDL Bound Test (Restricted Intercept; No Trend)

Computed F-statistic = 6.783420 (lag structure, k=4)			**Cointegration**
Bounds Level	**Lower I (0)**	**Upper I (1)**	
Critical Bounds Value (1%)	3.892	5.173	**Yes**
Critical Bounds Value (5%)	2.85	3.905	

Source: Computation by Authors based on outcome in EViews 11.
Notes: Narayan (2005) critical value for 5% significance level is I (0) =2.893, I (1) = 4.000 and for 1% significance level is I (0) = 3.967, I (1) = 5.455.

Estimation of Long and Short Run Parameters of the Growth Model

Since, the evidence of cointegration has being established in the model, the parameters estimation for the long run relationship are presented in Table 4. The result showed that GDP is swiftly responsive to food production, livestock and fishery outputs which is in accordance with the growth theories, where increases in total output indicates economic growth (Solow, 1956). Specifically the result indicates a unit increase in food production output gives about 0.003unit upswing in the nation's GDP. Likewise, livestock and fishery changes to GDP have positive and singnificant relationship. This implies that a unit increase in both (livestock and fishery) improves the nation's growth with 0.052 and 0.071 unit respectively. The estimation signifies that Nigeria' s economic outlook can improve as these agricultural sub-sectors (livestock, food production and fishery) will improve the total domestic production and discourage importation for these sectors. Thus, the finding is in line with Sertoglu et al. (2017), Azam and Shafique (2017) and Sui (2021) on agriculture and sub-sectors to be positively influencing nation's GDP in the long run.

In like manner, the error correction model is pertinent since there is support of the long run relationship among the variables. This application consolidates the short-run dynamics with the long-run and exhibits the speed of change from the short run towards the long-run equilibrium. Likewise, Table 4 details the outcomes obtained for the error correction model (ECM) assessment for the model uncovered that practically the autonomous variables have ended up being significant and altering to time. This is on the ground that the ECT co-efficient (Cointeq (-1) = -1.042230) has a negative sign and substantial at 1%, demonstrating the speediness of modifying in the short-run as shown in Table 4. The model tends to adjust its deviation from long run by rapid increase in the future GDP, without variations among the tested independent variables. This implies that the dependent variable (GDP) tends to return to its equilibrium level rapidly following the short-term disturbances/noise. Thus, the regression shows that in the short run, fishery, forestry, livestock, and food production were significant variables hypothesized to positively influence the GDP within the examined period. This result agrees with Mahta and Patel (2020) and Oyetade and Adeyeye (2021) that the past and previous components of agriculture yield an increase to the GDP of countries. Also, this is consistent with neo classical theory and expected since an increase in production of sectors such as agriculture results in overwhelming supply that improves the economic growth (Feder, 1982).

The finding in short run reveals that: first (1^{st}) and second (2^{nd}) lags of fishery; food production at the initial stage and 2^{nd} lag; 1^{st} and 3^{rd} lags of forestry; with the initial stage and 1^{st} lag of livestock were the significant variables hypothesized to influence the nation's GDP within this observed timeframe. This imply that a unit increase in fishery in the past 2 years will cause an approximate increase of 0.1 in current GDP. Also, evident from Table 4 is that an increase unit in food production and past years results in 0.005504 and 0.002991 unit

increase in GDP. This is however consistent with neo classical growth theory, since it is expected that increase in outputs result in nations' economic growth. It was also noticed that the earlier output of forestry both at 1st and 3rd lags negative, but significantly influenced the nation's GDP. In term of livestock, the past and current years significantly affect Nigeria's economy according to this outcome. The implication is that an increase unit of livestock at present-day increase GDP by 0.052444 unit, whereas GDP decreases by 0.041677 unit in a lag year. Additional information is given in Table 4 by comparing the findings with other articles in literature (Ali et al., 2019; Lawal et al., 2018; Fayçal & Ali, 2016). The result revealed that this study is in line with these existing studies since the coefficients are negative and statistically significant at 1%. The aligning of the findings to past literature is further affirmed by the conclusions drawn by Ewetan et al. (2017), Mcarthur and Sachs (2019), Oyetade and Adeyeye (2021), and Sui (2021) that agricultural output value significantly influences GDP.

Table 4. ARDL Error Correction Regression (Restricted Intercept; No Trend)

Variables	**Coefficient**	**T-Statistic**	**Prob.**
Long Run			
Fishery	0.071206	1.804089	0.0849*
Food Production	0.002991	3.063806	0.0057***
Forestry	0.089596	0.839590	0.4102
Livestock	0.052444	2.116126	0.0459**
Short Run			
C	-5.345329	-0.858818	0.3997
D(Fis)	-0.028080	-0.908018	0.3737
D(Fis)-1	0.128132	3.581051	0.0017***
D(Fis)-2	0.071206	2.344819	0.0285**
D(FP)	0.005504	8.214683	0.0000***
D(FP)-1	0.000469	0.543114	0.5925
D(FP)-2	0.002991	2.344819	0.0285**
D(For)	0.084759	1.267485	0.2182
D(For)-1	-0.279827	-4.602859	0.0001***
D(For)-2	0.089596	1.139822	0.2666
D(For)-3	-0.322647	-4.419734	0.0002***
D(Liv)	0.052444	3.285916	0.0034***
D(Liv)-1	-0.041677	-2.526290	0.0192**
CointEq(-1)	-1.042230	-7.067576	0.0000***
CointEq(-1) (Ali et al., 2019)	-0.5380	-3.09	***
CointEq(-1) (Lawal et al., 2018)	-0.077780	-5.644230	***
CointEq(-1) (Fayçal & Ali, 2016)	-1.208690	-30.211439	***
F-Statistic	6.783420	Prob.(F-Statistic)	0.000000***

Source: Computation by Authors based on outcome in EViews 11 and CointEq values from Ali et al. (2019), Lawal et al. (2018), and Fayçal and Ali (2016).
Notes: ***, **, * indicates the 1%, 5%, and 10% centrality level respectively.

Nonetheless, for additional thought on whether the factors cause or influences each other, the Pairwise Granger causality test was conducted. The outcome in Table 5 shows the causal connection between the part of agriculture outcome and GDP.

Table 5. Pairwise Granger Causality Test

	Obs.	**F-statistics**	**Prob.**
Fis does not Granger cause GDP	43	0.80225	0.4558
GDP does not Granger cause Fis		4.95276	0.0123***
FP does not Granger cause Fis	43	8.88334	0.0007***
Fis does not Granger cause FP		0.43204	0.6523
For does not Granger cause Fis	43	2.25480	0.1188
Fis does not Granger cause For		7.53065	0.0018***
Liv does not Granger cause Fis	43	8.96117	0.0006***
Fis does not Granger cause Liv		1.42884	0.2522
For does not Granger cause FP	43	1.25127	0.2977
FP does not Granger cause For		7.89166	0.0014***
Liv does not Granger cause FP	43	1.38197	0.2634
FP does not Granger cause Liv		4.17734	0.0229**
Liv does not Granger cause For	43	4.33012	0.0202**
For does not Granger cause Liv		0.87919	0.4234

Source: Computation by Authors based on outcome in EViews 11.

The findings in Table 5 reveal that the null hypothesis is rejected at 1% (0.0123, 0.0007 and 0.0006), inferring that economic growth, food production and livestock only cause fishery. While fishery and food production only cause forestry (0.0018 and 0.0014). The table also reveals that the alternative hypotheses are accepted at 5% (0.0229 and 0.0202), portraying that food production only cause livestock, which only cause forestry.

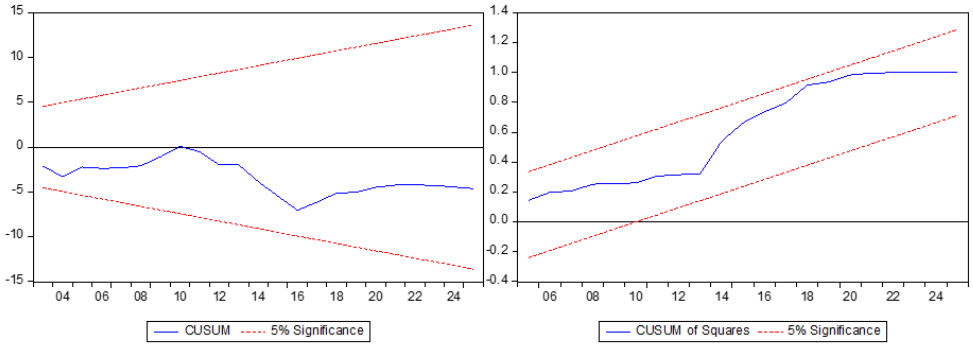
Finally, the diagnostic tests were conducted. The diagnostic test is conducted to test the capability of the model which should be steady with the standard thoughts of Ordinary Least Square (OLS) like the serial correlation, normality, heteroscedasticity, Cumulative Sum (CUSUM), Cumulative Sum Square (CUSUMSQ), and so forth. Sequential correlation shows whether a model is having autocorrelation issue that should not be vast at any level, while heteroscedasticity shows whether the unsettling influences are equivalent or steady difference in the model that should not be significant at any level. CUSUM and CUSUMSQ are applied to look at the stability for the long run relationship of the model that should be in the middle of the line for the test to be significant at 5% level altered. In like manner, Ramsey Reset tests whether there is presence of a few significant non-linear connections on the direct model utilized in the review that should not be significant at any level (Pesaran & Pesaran, 2009).

Table 6. Diagnostic Tests

Tests		**Statistics**	**Probability**
a. Normality test		1.877175	0.391180
b. Breusch-Godfrey Serial Correlation LM test:	F-statistics	0.530674	0.5963
	Obs R-squared	2.066118	0.3559
c. Heteroskedasticity test:	F-statistics	1.796341	0.0959
	Obs R-squared	24.39902	0.1424
d. Ramsey Reset test:	F-statistics	0.909024	0.3512

Source: Computation by Authors based on outcome in EViews 11.

Table 6 shows the Breusch-Godfrey consecutive connection LM test exhibit that F-measurement reciprocals to be 0.530674 and the Prob.F (2, 20) which is 0.5963 is inapt. This shows the evaluated model have no degree of similarity and lagged version between a given time series or intervals (autocorrelation). The Breusch-Pagan-Godfrey test for unequal scattering within variables (heteroscedasticity) show that F-statistic = 1.796341 and the Prob.F (18, 22) is 0.0959. Moreover, the Ramsey Reset test show that the F-statistics equals 0.909024 with the likelihood of 0.3512.



Source: Authors' construction

Figure 1. CUSUM and CUSUMSQ Tests for Stability

Likewise, the "CUSUM" and "CUSUMSQ" tests for steadiness are displayed in Figure 1. The figure reflects that the model is stable and alternative hypothesis can be rejected since the plotted lines lie within the 5% range of significance level. Thus, implies that the null hypothesis of coefficients in ECM are stable and accepted.

5. Conclusion and Recommendations

This research work has given perceptive and intuitive influence of agriculture's role to the production growth of the nation for the time frame studied. The higher derivative block method numerical solution of the logistic growth model was effective in providing the required forecast values of the variables selected within the chosen duration of the investigation. Additionally, the ARDL strategies adopted to obtain an insight at the connection between the driving forces of this sector and GDP demonstrates that there is evidence of long run balance association/link among the factors or variables. In addition, the pairwise Granger causality test demonstrates that a single direction causal effect exists among the factors of the model. This connotes that fishery does not prompt GDP but the other way around, moreover GDP prompts forestry. Similarly, it was apparent that food production does prompt the remaining agricultural components (fishery, forestry, and livestock). Also, livestock does stimulate fishery and forestry.

Hence, the study had the option to highlight the positive and critical piece of the part/component to be the food production and livestock according to the findings. In this way, the study explicitly reveals that these sectors (food/crop production and livestock) truly matter for the economic development and growth of the country.

Based on these findings, it is recognizable that food production and livestock are critical and fundamental for financial growth and development in Nigeria. Thus, certain propositions are recommended as highlighted below:

- Cultivation of extra land regions mostly for the production or creation of food sources or crops which will be in line towards the green movement. Examples include nations like South Africa and Sudan devoting about 96 and 113 million hectares of land to growing crops respectively.
- Provision of modernized devices such as farm haulers (tractors), grower/planters, that will hasten works should be put into consideration. Such as Netherlands being known for greenhouse technology and precision agriculture. This is to ensure more and better crops/harvest/food yielding. In like manner, incubation center or hatcheries, feed machines and so forth ought to be accessible for use to further develop the livestock agricultural sector.
- Private sectors/parastatals ought to be encouraged on extending their organizations in taking more parts in the food creation and livestock through more monetary aid and patronizations by the public authority.

Consequently, the review suggests that these parts of agricultural sector (food production and livestock) should still be focus on by giving soft credit facilities/ scheme to farmers with low or no lending rate through banks. This is to encourage small owners of farms to increase agricultural output that can cushion the threat of the country's food insecurity.

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