REVISITING AGRICULTURAL SECTOR NEXUS ECONOMIC GROWTH IN NIGERIA

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Abstract

Undoubtedly, the agricultural sector is one sector in an economy that plays a crucial role in any country. However, in Nigeria, the rate at which food insecurity and prices are increasing is alarming. According to the National Bureau of Statistics, the average food inflation rate in Nigeria from 1996 to 2024 is 13.50%. Conversely, the cost of food in Nigeria reached an all-time high value of 40.87 percent in June 2024. This clearly indicates a decline in the sector's performance. Therefore, this study aimed to assess the relationship between the agricultural sector and economic growth in Nigeria from 1991 to 2022. The study uses a descriptive research method and the autoregressive distributed lags model (ARDL) to examine both the short-run and long-run relationships. Findings revealed that the agricultural sector significantly and positively affects economic growth in Nigeria. Among others, the study recommends that the government takes deliberate steps to enhance human capital development in the agricultural sector, which can be achieved by organizing vocational training programs.

Keywords: ARDL, Nigeria, Agricultural Sector, Agricultural Output

JEL Classification: Q40, Q41, Q43

1. INTRODUCTION

The agricultural sector, overtime, has never failed to serve as a means of sustenance to man and his family in numerous ways. Starting out with the man, agriculture opens up the gates of employment for him but, most importantly, opens widely the doors of wealth to a man and his family. To the woman, agriculture offers her both direct and indirect means of becoming an independent woman as well as caring for herself and her family, as well as a source of income to her through the direct means of hard work, administration, or management on the farm, while the indirect means of creating wealth for herself by the transformation of this agricultural produce into products that are widely demanded, for example, organic beauty (skincare and haircare) products. For children, apart from the food it provides, commodities formed from the transformation of this agricultural produce make up an integral part of their lives. For examples, paper, tissue, and books from wood; shoes and bags from leather; essential oils for body lotions from flowers and plants; and many more. And down to the whole family, agriculture offers the treasure of producing a healthy and well-nourished family through the food it provides, which ultimately in the long run produces a healthy and happy nation, just like families make up a nation. Therefore, the importance of agriculture cannot be overemphasized. However, increasing temperatures, frequent extreme weather events, changes in precipitation patterns, floods, and unavailability of water may all result in declining agricultural productivity. Therefore, affects the four major sub-sectors in Nigeria-crops, livestock, forest, poultry and fish farming (Rizwan, 2023). Though, the crop production sector still remains the largest subsector, making it the primary driver of the agricultural sector's growth by playing a big role in providing food, oil, feeds, and fiber for consumption in Nigeria. On average, between 1981 and 2022, the sub sector accounted for about 65% of agricultural gross domestic product (Food and

The Food and Agricultural Organisation (2023). The second largest subsector comes the livestock production subsector which involves the production and management of livestock (goats, ducks, sheep, cattle, pigs, chickens) either for domestic consumption, sale or pleasure. Compared to the crop production subsector, between 1960 and 2022, the subsector grew from 11% in 1981 to about 37% in 2022, mirroring a growth rate of 26% within the past 41 years (FAO, 2023). This sub-sector has become an increasingly important part of the agricultural sector, with significant growth in poultry and dairy production. Moreover, there is the fishery sub-sector, of which involves the raising or harvesting of fish and other aquatic life for commercial purposes. It has accounted for about 1-2% of the agricultural gross domestic product in Nigeria, during the period of 1981 to 2022. Finally, the last subsector, known as forestry, remains the smallest and also the least recognized. The subsector accounted for only 2-3% of agricultural gross domestic product in Nigeria from 1981 to 2022 (FAO, 2023).

For economic growth, according to World Bank (2000), it has been defined as a measure of change in the volume of its output or in the real expenditure or income of its citizens. Economic growth can also be described an increase in the capacity of a nation to produce economic goods and services over a given time period when compared to the prior period. The growth of any economy is driven by a number of components such as; natural resources, physical capital, human capital, technology among others. The relationship between the agricultural sector and economic growth in Nigeria seeks to justify if the sector has continued to contribute significantly to economic growth. Between the period of 1960 and 1970, agriculture accounted for 55.8% of the GDP. Unfortunately, it fell drastically to 28.4% between 1971 to 1980, majorly due to the discovery of oil. However, there was a rise from 1981 to 1990 at 32.3% and from 1991 to 2001 and 2001 to 2009, the sector had accounted for approximately 34% and 40% of total GDP respectively (Mohammed, 2016). Notwithstanding, current significant contribution of the sector to GDP makes it, therefore mandatory to assess the relationship between the agricultural sector and economic growth in Nigeria.

Therefore, this paper examines the relationship between agricultural sector and economic growth in Nigeria. The study further investigates the causality between agricultural sector and economic growth in Nigeria. The remainder of the study is as follows: Section two reviews the previous literature related to agricultural sector and economic growth. The third section explains the methodology employed in the study. Section four reveals the empirical outcomes of the paper. Finally, the conclusions and policy implications are discussed in session five.

2. LITERATURE REVIEW

In order to develop a sound and innovative research work, it is important to review some existing theories relevant to the relationship between the agricultural sector and economic growth, and also review both the conceptual and empirical literature. In view of this, this paper reviews the Solow-Swan Neoclassical growth theory and Fei-Ranis Theory.

2.1. SOLOW-SWAN NEOCLASSICAL GROWTH THEORY

The Solow-Swan neoclassical growth theory provides a valuable theoretical framework for investigating the relationship between the agricultural sector and economic growth. This theory, developed by Robert Solow and Trevor Swan, focuses on the long-term determinants of economic growth, emphasizing the roles of technological progress and capital accumulation. In the context of the agricultural sector, the Solow-Swan model can be applied to analyze how investments in agricultural productivity and efficiency impact on economic growth. This theory can also be utilized to study the effects of technological advancements, such as the adoption of new farming techniques or the introduction of innovative agricultural practices, on the sector's output and productivity.

Additionally, by incorporating data on capital accumulation in the agricultural sector, such as investments in infrastructure, research and development, and human capital, it would be possible to assess how these factors contribute to economic growth. Also, the Solow-Swan model allows for the examination of how changes in agricultural productivity influence overall economic performance, including GDP growth, income levels, and poverty reduction. In overall, the Solow-Swan neoclassical growth theory offers a robust framework for investigating the relationship between the agricultural sector and economic growth. In the diagram shown in Figure 1 below, the theory shows the relationship among the relevant variables as propounded by the theory.

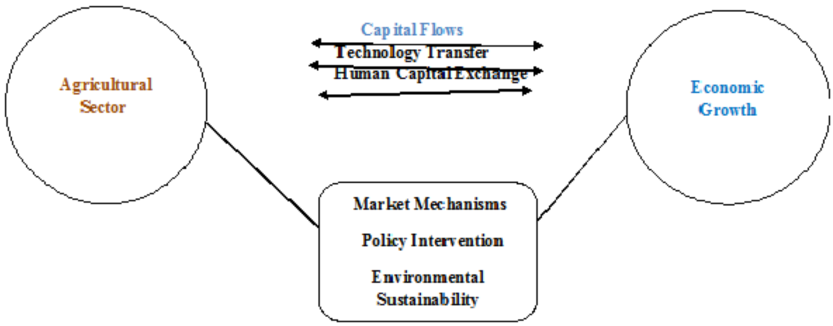

Figure 1: *Solow-Swam Neoclassical Growth Theory Framework*
Source: Authors Computation (2024)

2.2. FEI-RANIS THEORY

The Fei-Ranis theory, developed by economists J.C.H. Fei and Gustav Ranis, is a dual-economy model that examines the relationship between the agricultural sector and economic growth in developing countries. The theory posits that economic development occurs in two distinct sectors: the traditional agricultural sector and the modern industrial sector. While the traditional agricultural sector is characterized by low productivity, surplus labor, and stagnant growth, the modern industrial sector is associated with high productivity, capital accumulation, and dynamic growth. Therefore, the theory argues that the transition from a traditional agrarian economy to a modern industrial economy is essential for sustained economic growth and development.

Furthermore, to investigate the relationship between the agricultural sector and economic growth using the Fei-Ranis theory, various factors can be analyzed to influence the transition process. These factors may include investment in human capital, technology adoption, infrastructure development, and government policies aimed at promoting industrialization. By examining the interactions between these variables, researchers can assess the extent to which the agricultural sector contributes to overall economic growth and identify strategies to accelerate the transition to a modern industrial economy. Ultimately, the Fei-Ranis theory offers a framework for understanding the complexities of economic development and guiding efforts to achieve inclusive growth and poverty reduction.

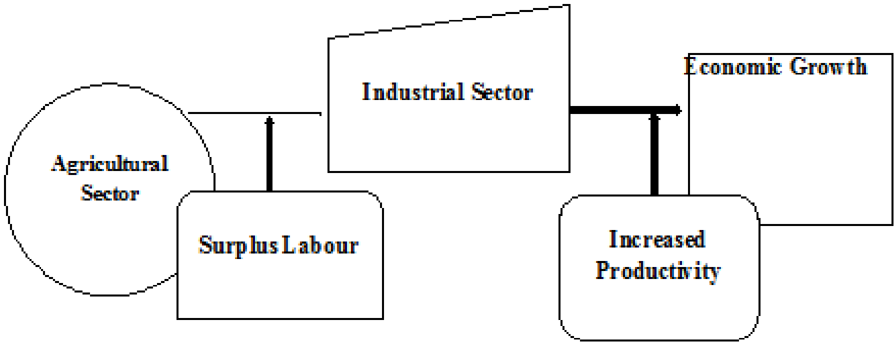

Figure 2: *The Fei-Ranis Theory Framework*
Source: *Authors Computation (2024)*

2.3 REVIEW OF EMPIRICAL LITERATURE

This section sheds light on important past studies that are connected to the techniques utilized in this research and are used as references to improve the empirical section of this paper. Numerous studies have examined the relationship between the agricultural sector and economic growth, although there are considerable differences of opinion. While some researchers have argued that the agricultural sector is the cornerstone of economic growth (Gollin, Parente & Rogerson, 2002; Thirtle, Lin & Piesse, 2003), others have countered that the sector is insufficient for fostering economic growth because of its weak links with other sectors (Ranis and Fei, 1961; Jorgenson, 1961). The empirical review would be carried out from three perspectives; developed countries, developing countries and Nigeria.

According to Gardner (2005) and Chebbi (2010), there are many unanswered problems surrounding how the agricultural sector affects economic growth. Lavorel, Storkey, Bardgett, Bello, Berg, Roux, and Harrington (2013) responded to Gardner's (2005) concerning the research question: Is agriculture an engine of growth? The paper considered 85 nations by examining the causal relationship between agricultural value added per worker and gross domestic product (GDP) per capita. Their research made a significant claim, and they concluded that while the relationship between agricultural value added and growth in wealthy countries was uncertain, it existed for emerging ones. This fact supports the notion that the agricultural sector has served as the bedrock of developing economies, which was made earlier.

Likewise, Awokuse and Xie (2014), in their paper, analyzed the role of agriculture as an engine of growth for 15 developing and transition economies in Africa, Asia and Latin America with the aid of the autoregressive distributed lag (ARDLs) model proposed by Pesaran, Shin and Smith (2001). It was used to determine if a long-run relationship exists between the variables for each country in the analysis. The Akaike information criterion (AIC) was used to choose the best lag lengths while making sure that the estimated residuals are not serially correlated. The calculated test statistic exceeds the critical value upper boundaries calculated by Pesaran, Shin, and Smith (2001) in each case. Thus, findings suggest that, at the 10% level of significance, the null hypothesis of non-cointegration is rejected for all the countries. As a result, the findings imply that agriculture and GDP growth across the nations have a long-term relationship for all the countries.

Furthermore, Matahir (2012) examined how agricultural sector influences other economic sectors and contributes to economic growth. This investigation was carried out in Tunisia and it looked at the non-causality relationship between the agricultural and other economic sectors of the country. To do this, time series Johansen co-integration techniques were used. He found out that even though Tunisia's growing service and commerce sectors have not greatly contributed to the country's agricultural sector, it is however, impossible to overstate the importance of the agricultural sector to the country's overall economic growth. This is supported by research on the Thai economy carried out by Jatuporn, Chien, Sukprasert and Thaipakdee (2011), who carried out a study to examine the relationship between the agricultural sector and economic growth in Thailand. The study's findings suggested a bi-directional relationship between the agricultural sector and economic growth and recommended that agriculture should be valued by policymakers as a significant economic driver in Thailand.

Also, Srikanth and Sathyanarayana (2011) conducted research on the co-integration and causal relationship between GDP and agriculture sector in India. The study discovered a long run relationship between agriculture and GDP. Further, the Granger causality test's findings suggested a bidirectional causal relationship between GDP and agriculture sector in the country. Similarly, in 2012, Raza, Ali, and Mehboob, did research on the contribution of agriculture to Pakistan's economic growth. Their findings indicate that, while forestry had an insignificant effect on GDP, the other agricultural subsectors including crop production, livestock production and fishery had a substantial influence in the growth of the economy.

Specifically, in the context of Nigeria, the relationship between the agricultural sector and economic growth was analyzed by Amefula (2019). The study delved into how the agricultural sector influences Nigeria's economic growth by employing the ADF unit root test, linear multiple regression model, and percentage ratio measure. The ADF unit root test indicated that the stationarity of the variables is achieved at the first log difference. The finding revealed that all the agricultural variables have insignificant positive relationship with economic growth except crop production that has significant positive effect on economic growth. Also, the result using the trend pattern of percentage ratio measure showed that agricultural sector contributes positively to economic growth in Nigeria. As a result, the paper recommended that the government and stakeholders in the agricultural sector focus on enhancing sub-sectors like fishery, forestry, and livestock to further bolster the sector's contribution to Nigeria's economic growth.

In the same manner, Oguwuike, Wisdom, and Tobechi (2018) also examined the effect of the agricultural output on Nigeria's economic growth from 1981-2016. Using econometric methods of Parsimonious Error Correction Model, the study found that variables such as GDP, crop production, livestock, fishery, and forestry were stationary. The study also revealed a significant co-integration among these variables. The first and third lags of GDP were positively associated with current economic growth. The coefficient of crop production was positively signed and statistically significant at a 5% level. However, the coefficient of forestry was negatively signed but statistically significant at a 5% level with GDP. The study recommends the Nigerian government to implement effective structures to enhance agricultural output, such as diversifying revenue sources, revitalizing agricultural institutions, and implementing realistic long-term development plans.

Furthermore, the study conducted by Amire (2016), aimed at investigating the impact of agricultural productivity on economic growth in Nigeria using data from 2000 to 2014. The ordinary least square (OLS) method is used for analysis. The results show a long-term relationship between agricultural productivity and economic growth. Variables such as GDP contribution from agriculture, agricultural expenditure, and access to agricultural loans all had positive effects on economic growth in Nigeria and were correlated using the Pearson correlation coefficient. These findings have significant implications for agricultural policy in Nigeria. The study recommends that policymakers focus on improving the productivity of the agricultural sector to increase production capacity, leading to higher output and ultimately driving economic growth.

Correspondingly, Olabanji et al. (2017) in their study also looked into the relationship between agricultural output and economic growth in Nigeria from 1981 to 2014 using time series data. Using the Johansen maximum likelihood co-integration method and vector error correction model, they provide support for a long-term connection between agricultural output and economic growth in Nigeria. The study however recommends that the government should reinforce agricultural policies in terms of financial support, storage infrastructure, and market accessibility to boost agricultural productivity as well as attract investors and encourage young people to return to the agricultural sector.

Further, Awoyemi, Afolabi and Akomolafe (2017) analyzed how agricultural productivity has influenced the economic growth of Nigeria from 1981 to 2015. The Johansen cointegration test was utilized to establish whether there was a long-term relationship between agricultural productivity and economic growth. Additionally, an Error Correction Model (ECM) was used to assess the short-term impact of agricultural productivity on economic growth. The findings revealed that both agricultural labor productivity and agricultural value added had a positive impact on economic growth. Based on these results, it can be inferred that enhancing the performance of the agricultural sector plays a crucial role in boosting economic growth in Nigeria. As a result, it is recommended that the government promotes greater participation in the agricultural sector by increasing investments within the industry.

Similarly, review of the impact of the agricultural sector on the Nigeria's economic growth conducted by Oji-Okoro (2011), used multiple regression to examine the data collected. The findings showed that GDP with regard to domestic savings, government spending on agriculture, and foreign direct investment (FDI) all have a positive relationship. The study also showed that 81% variations in GDP could be explained by domestic savings, government expenditure on agriculture and foreign direct investment (FDI). Likewise, Izuchukwu (2017) analyzed the role of the agricultural sector on the economic growth of Nigeria and discovered that a positive relationship existed between GDP with regard to domestic saving, government expenditure on agriculture and foreign direct investment.

Also, Onunze (2018), who used an Ordinary Least Square Regression technique of research in his paper titled "the impact of agricultural development on Nigeria economic growth," discovered that agricultural productivity had a positive impact on economic growth during the years 1980 to 2016. Additionally, he confirmed his findings that, during the course of the study year, agricultural progress has created potentials for economic growth. Likewise, similar research carried out by Oluwafemi, Adedokun, Ogunleye, and Oladokun (2015) studied the impact of the agricultural sector on the Nigerian economy. Tools such as descriptive statistics and the error correction model (ECM) were used to analyze the data that was provided. According to the descriptive statistics, Nigeria's economy has increased during the past 32 years, as seen by the bigger difference between the minimum and maximum values of the GDP and agricultural output, respectively. The agricultural output coefficient was determined to be positive and statistically significant at the 1% level, and the R2 coefficient was approximately 0.96. The coefficient of ECM (u-1) was significant at the 1% level, indicating that the GDP, agricultural output, and inflation were co-integrated.

Using annual data gathered from the Central Bank of Nigeria, Ideba, Iniobong, Otu, and Itoro (2020) evaluated the relationship between agricultural public capital expenditure and economic growth in Nigeria for the period of 1971 to 2018. The Augmented Dickey-Fuller test, Johansen maximum likelihood test, and Granger Causality test were used to analyze the data. The Johansen co-integration test's outcome demonstrated that all of the explanatory factors and the explained variable have a long run relationship. The outcome of the sparse error correction model demonstrated that public investment in agriculture has a favorable effect on economic expansion. A unidirectional association between agricultural public capital spending and agricultural economic growth was also demonstrated by the Granger Causality test.

Aminu & Anono (2020) likewise, used the Augmented Dickey-Fuller technique to test the unit root property of the series, and then the Chow breakpoint test to determine whether there was a structural break in the economy. This investigation looked at how much the agricultural and petroleum sectors contributed to the GDP of the Nigerian economy between 1980 and 2018. The results of the Chow breakpoint test and the unit root test indicate that there is no structural break in the period under consideration, and all the model's variables are stationary at first difference, respectively. The findings also showed that, despite having a similar positive influence on economic growth and development, the agriculture sector contributes more than the petroleum sector. Therefore, a well-developed agricultural sector can be credited with an economy's strong performance in terms of per capita growth.

In the same vein, Oyinbo & Rekwot (2018) also demonstrated an empirical association between agricultural productivity and the growth of the Nigerian economy. This was carried out with an emphasis on reducing poverty. Time series data were used in the study, and the data were analyzed utilizing the (ARDL) testing for co-integration and the unit root test. The analysis of the data revealed that agricultural production had a positive impact on the trend of Nigeria's economic growth. Also, a different study by Olagunju, Ogunniyi and Ogundipe (2016) used data for the years 1981–2013 and the ARDL technique to estimate the relationship between agriculture and economic growth. The study discovered that agricultural output, agricultural credit, and government expenditure on agriculture had positive and significant effects on economic growth in Nigeria. It also discovered that the impact of agriculture on economic growth was stronger in the short run than in the long run.

Agboola, Bekun, Osundina and Kirikkaleli (2022) also investigated the contribution of various agricultural subsectors to Nigeria's economic growth and suggested policy implications for investing in each. Data from 1981 to 2016 were analyzed using various tests, including Johansen cointegration, Gregory–Hansen test, vector error correction model, dynamic ordinary least squares, fully modified ordinary least squares, Granger causality, and frequency domain causality test. Results showed a one-way causality between various agricultural subsectors and economic growth, suggesting the need for diversification in the agricultural sector for sustainable growth. The long-term effects of forestry, crop production, and fishery are statistically significant and positive. Another paper by Okuduwor, Amadi and Udi (2023), examined the effects of agricultural exports, exchange rates, and trade openness on Nigeria's economic growth from 1999 to 2020. The data used in this analysis was obtained from the World Development Indicator (WDI) and the Central Bank of Nigeria's (CBN) Statistical Bulletin. The empirical results indicated that the growth rate of Gross Domestic Product (GDP) and agricultural exports exhibit stationarity, whereas exchange rates and trade openness display non-stationarity. Employing the Autoregressive Distributed Lag (ARDL) method, the findings suggested that agricultural exports have a positive impact on economic growth and exchange rates also exerted a positive and significant influence on the Nigerian economy. However, the result showed that trade openness has a positive and insignificant impact on economic growth. In light of these findings, it is recommended that the Federal Government invest in the agriculture sector to optimize its contribution to Nigeria's economy.

Furthermore, the study by Ceesay, Francis, Jawneh, Njie, Belford and Fanneh (2021) examined the causal relationship between climate change, agriculture value added, food production, and economic growth in the Gambia. It used data from 1960-2017 and employed the ARDL approach and granger causality framework. Results showed that growth in fish and livestock production had significant positive impacts on GDP growth, while growth in food import and agriculture had negative impacts. Also, Granger causality analysis revealed unidirectional relationships between GDP growth and food availability indicators, with agriculture growth indirectly causing GDP growth. It was also found that a bidirectional relationship exists between the lagged values for growth of crop production and growth of agriculture. Therefore, the resilience shown by the agricultural sector in Nigeria during specific times of her life is demonstrated by its capacity to bounce back from shocks caused by disruptive events, such as the civil war (1967–1970) and economic recession (1981–1985) periods, more swiftly than other sectors. It was also discovered that the agricultural sector's growth is heavily dependent on the development of the crop production subsector, which makes sense given that it is responsible for the majority of it. This demonstrates the significance of this subsector and likely demonstrates a lack of interest or funding for the other subsectors, Odetola & Etumnu (2017).

So, in conclusion, the empirical findings point to the fact that the agricultural sector has a positive effect on economic growth in Nigeria. However, a number of factors, including infrastructure, financing availability, and productivity, may affect how strongly the relationship is between the agricultural sector and economic growth. The contributions of the agriculture sector to economic growth in Nigeria may be increased with the help of policies and initiatives focused at tackling these issues.

3. METHODOLOGY AND DATA

3.1 DATA

The study uses time series data over the period 1991–2022 to empirically analyze the relationship between agricultural sector and economic growth in Nigeria. The selection of the variables has been guided by the objective of the study and the previous empirical literature in the field of study (see, Awokuse and Xie, 2014 and Oyinbo and Rekwot, 2018). The summary of the variables used in this paper is shown in Table 1 below:

Table 1: Summary of variables, description, measurement and sources of data

Variables	Description of Variables	Measurements	Sources of Data
Economic Growth (GDPN)	Economic growth describes an increase in the capacity of a nation to produce economic goods and services over a given time period when compared to the prior period.	Gross Domestic Product of Nigeria (Current US$)	World Development Indicators, 2022.
Agricultural Output (AGOP)	Agricultural output refers to the quantity and quality of products generated from agricultural activities. It encompasses the yield of crops, livestock products, and other agricultural commodities such as forestry and fishing products.	Agriculture, forestry, and fishing, value added (current US$)	World Development Indicators, 2022
Labour (ALAB)	Labour/ labor force comprises people ages 15 and older who supply labor for the production of goods and services during a specified period. It includes people who are currently employed and people who are unemployed but seeking work as well as first-time job-seekers.	Agriculture, forestry, and fishing, value added (% of GDP)	World Development Indicators, 2022.
Capital (GFCF)	Capital goods or capital are those durable produced goods that are in turn used as productive inputs for further production of goods and services.	Gross Fixed Capital Formation, (% of GDP)	National Bureau of Statistics, 2022

Source: *Authors Computation (2024)*

3.2. ECONOMETRICS TECHNIQUES

The study employed the following econometrics techniques in estimating the relationship between the agricultural sector and economic growth in Nigeria, namely; descriptive statistics, unit root test, cointegration, autoregressive distributed lags (ARDL) bound test, ARDL short-run and long-run, as well as the pairwise Granger causality test.

3.2.1 DESCRIPTIVE STATISTICS

Descriptive statistics involves organizing, analyzing, and presenting data in a meaningful way to provide insights into the characteristics of the data. It involves the use of measures of central tendency (mean, median, mode) and measures of dispersion (range, variance, standard deviation) to understand patterns and trends so as to interpret and draw conclusions from the research work.

3.2.2. UNIT ROOT TEST

This is the first step to be carried out before macro-economic data analysis can adequately be examined: to examine the stationarity of the data. To achieve this, a unit root test is a statistical method widely employed in the literature to test the order of integration of the individual variables, that is, to determine if a time series data set is stationary or non-stationary. Stationary data shows a constant mean and variance, while non-stationary data shows changing trends. A study by Bekun et al. (2019) found that empirical research on time series suggests that observed data is often stationary. This means the data has a consistent mean, variance, and auto-covariance across different time intervals. However, the study also noted that many macroeconomic variables tend to exhibit trends, meaning that the data grows over time. Working with non-stationary data can lead to spurious regression, as mentioned in the works of Granger and Newbold (1974) and Nelson and Plosser (1982), so to address this, a unit root test is essential to determine if the data follows a stable pattern and if differencing is necessary for further analysis.

Over time, several procedures have been developed to carry out this test for the order of integration, and the most popular is the Augmented Dickey-Fuller (ADF) test, an extension of the Dickey-Fuller test that allows for more complex models by including lagged differences of the dependent variable in the regression equation. By analyzing the significance of the test statistic against critical values, researchers can assess whether the data is stationary or non-stationary. Furthermore, the result of the unit root test indicates what method of analysis will be applied. When all the variables are in the same order, I(0) or I(1), the Johansen method of cointegration is applied. On the contrary, when they are integrated in the mixture of orders of I(0) and I(1), the ARDL is applied.

3.2.3. CO-INTEGRATION TEST

The co-integration test is a statistical method used to analyze the long-term relationship between non-stationary time series variables. This study will however consider the ARDL model, which allows for stationary and non-stationary variables in the same regression equation. The model involves regressing the dependent variable on lagged values of itself and the independent variables and also examines the coefficients of lagged variables to determine if they are statistically significant and indicate a long-term relationship between variables.

3.2.4. ARDL BOUNDS TEST

The autoregressive distributed lags model (ARDL) bounds test is a specific test within the framework of the ARDL model that is used to determine the presence of co-integration between variables. This bounds test procedure uses the F-statistics to see if the lagged variables in the model are statistically significant. According to Pesaran et al. (2001), the test involves comparing the F-statistics with asymptotic critical values. If the F-statistics exceed the upper critical value, it indicates that the null hypothesis (that there is no co-integration) be rejected. On the other hand, if the calculated F-statistics falls below the lower bound, it suggests no co-integration. However, in cases where the F-statistics lie within the respective bounds, the co-integration test would provide inconclusive results. Once the co-integration is detected, the error correction model (ECM) is estimated. It represents the error correcting term that indicates the speed of adjustment back to long-run equilibrium after a short-run disturbance. It is expected that the coefficient of the error term is negative and statistically significant. When this occurs, it indicates the speed of adjustment and how quickly the variables will return to the long-run equilibrium.

3.2.5. ARDL SHORT AND LONG RUN ESTIMATION

As stated earlier, it is believed that most macro-economic variables are not stationary at level. Thus, the choice of autoregressive distributed lags (ARDL) is informed by the mixed order of integration obtained from the unit root test. The advantage of this ARDL over the traditional method is that the ARDL is flexible and dynamic. Therefore, this study adopts the autoregressive distributed lags (ARDL) to estimate the relationship between the agricultural sector and economic growth in Nigeria. The ARDL-ECM functional model to estimate the data can be constructed as follows:

$$lnGDPN_t = \beta_0 + \lambda_1 lnGDPN_{t-1} + \lambda_2 AGOP_{t-1} + \lambda_3 ALAB_{t-1} + \lambda_4 GFCF_{t-1} + \sum_{i=0}^{p} \eta_i \Delta lnGDPN_{t-i} + \sum_{i=0}^{q1} \theta_i \Delta lnAGOP_{t-i} + \sum_{i=0}^{q2} \delta_i \Delta lnALAB_{t-i} + \sum_{i=0}^{q3} \phi_i lnGFCF_{t-i} + ECT_{t-1} + \mu_t \quad \ldots\ldots (1)$$

where,

$lnGDPN_t$ is denoted as natural logarithm of gross domestic product used as a proxy for economic growth

$lnAGOP_t$ is denoted as natural logarithm of agricultural output

$lnALAB_t$ is denoted as natural logarithm of agricultural labour

$lnGFCF_t$ is denoted as natural logarithm of gross fixed capital formation used as a proxy for investment

β_0 = Constant term

μ_t= stochastic/ residual/ error term

$\sum$ denotes short-term dynamics

λ_i represents long term multipliers

3.2.6. PAIRWISE GRANGER CAUSALITY TEST

The Granger causality test examines whether the past values of one variable provide significant information for predicting the future values of another variable beyond what can be predicted by the past values of the second variable alone. If the test results show that two variables Granger-causes one another, it suggests that there is a causal relationship between the two variables. However, the most common way to test the causal relationships between two variables is the Granger causality test proposed by Granger (1969). In order to examine the causal relationship between the agricultural sector and economic growth of Nigeria, the following models are specified:

$$GDPN_t = \beta_0 + \beta_1 AGOP_t + \beta_2 ALAB_t + \beta_3 GFCF_t + \mu_t$$
$$AGOP_t = \beta_0 + \beta_1 ALAB_t + \beta_2 GFCF_t + \beta_3 GDPN_t + \mu_t$$
$$ALAB_t = \beta_0 + \beta_1 AGOP_t + \beta_2 GFCF_t + \beta_3 GDPN_t + \mu_t$$
$$GFCF_t = \beta_0 + \beta_1 AGOP_t + \beta_2 ALAB_t + \beta_3 GDPN_t + \mu_t \text{------------------------(2)}$$

3.2.7. DIAGNOSTIC TESTS

After the regression estimates have been gotten, the results were diagnosed to verify the adequacy and stability of the regression model, residual normality and serial correlation amongst others. Consequently, for the purpose of this study, the five major diagnostic and stability tests were carried out so as to make sure that the estimated model is strong and reliable. These are; residual normality, serial correlation heteroscedasticity, specification and the stability test, all of which would be explained below.

First and foremost, the serial correlation test; this is a statistical test used to determine if there is a systematic relationship between the observations at different time points, which can impact the reliability of statistical models and forecasts. On the other hand, there is the heteroscedasticity test which is used to check for the presence of unequal variance in the errors of a regression model. It helps to determine whether or not a regression model’s ability to predict the target variable is consistent across all values of that variable. Hence, heteroscedasticity occurs when a model can consistently predict the low values of the dependent variable but not its high value (or vice-versa). In such instances, estimated models cannot be trusted as relevant explanations of their target variables.

Furthermore, the specification test is used to measure the adequacy of the model. The test helps to determine whether the chosen model is appropriate for the data at hand and whether the model's assumptions are met. It also checks whether adding more independent variables would better explain the dependent variable. However, for this study, Ramsey’s Regression Specification Error Test (RESET) will be employed to test whether the model was well specified.

Lastly, the stability test; it is a procedure used to check if the relationships and patterns observed in a model remain consistent over time or across different samples. It helps to ensure that findings generated from the study are robust and not just a result of random fluctuations in the data. Hence, this study adopts the CUSUM (Cumulative Sum) test for stability, which is based on the cumulative sum of the recursive residuals, the 5% critical lines.

4. RESULTS AND DISCUSSION OF EMPIRICAL FINDINGS

4.1. DESCRIPTIVE STATISTICS

Table 2 shows the descriptive statistics of the variables used in the data analysis. A total of 32 observations were analysed in this study. According to the table, the mean value of the logged Gross Domestic Product of Nigeria (GDPN) through the period was 26.07524, while that of the logged agricultural output (AGOP), agricultural labour (ALAB), and gross fixed capital formation (GFCF) are 24.65048, 3.498878, and 3.220407, respectively. This mean value describes the centre of the data set. On to the next, the standard deviation, which shows how spread out the data set is from the mean, is given as follows: 0.796685, 0.610130, 0.313499, and 0.403606 for economic growth (GDPN), agricultural output (AGOP), labour (ALAB), and capital (GFCF), respectively.

Furthermore, the descriptive result also revealed the skewness and kurtosis value for each data set. It revealed that all variables showed a negative skewness value (i.e., a long-left tail) whose data distribution is fairly symmetrical around the mean since their values lie between -0.5 and +0.5. Likewise, all kurtosis values of all data revealed that all values are platykurtic (i.e., the data distribution is flat-peaked, indicating a negative kurtosis, whose value is less than 3). Finally, the Jarque-Bera test (prob.) also showed that all variables, GDPN, AGOP, ALAB, and GFCF, are all normally distributed, as all probability values are greater than the 5% level of significance.

Table 2: *Descriptive statistics table*

	GDPN	**AGOP**	**ALAB**	**GFCF**
Mean	26.07254	24.65048	3.498878	3.220407
Median	26.27464	24.89268	3.554827	3.262503
Maximum	27.07622	25.46629	4.005203	3.879504
Minimum	24.67563	23.08212	2.986700	2.651037
Std. Dev	0.796685	0.762007	0.313499	0.403606
Skewness	-0.472901	-0.770691	-0.254030	-0.018253
Kurtosis	1.748513	2.212314	1.631235	1.626631
Jarque-Bera	3.281014	3.995080	2.842189	2.516632
Probability	0.193882	0.135669	0.241450	0.284132
Sum	834.3214	788.8152	111.9641	103.0530
Sum Sq. Dev	19.67592	18.00032	3.046728	5.049825
Observations	32	32	32	32

Note: *Eviews 12 was used to generate the descriptive statistics*
Source: *Author's computation (2024)*

4.2. UNIT ROOT TEST RESULTS

To further identify the trend movements of the variables according to econometric standards, the augmented dickey-fuller unit root test was performed. The diagnostic test result is presented in this section with the test for stationarity. The unit root test results showed that economic growth (GDPN), agricultural output

(AGOP), agricultural labour (ALAB), and capital (GFCF) all became stationary at first difference 1(1). See table 3 below:

Table 3: *Unit Root Test Results*

Variables	ADF t-test @ first difference	Mackinnon Critical Value @ 1%	Mackinnon Critical Value @ 5%	Order of Integration
GDPN	-4.832132	-4.296729	-3.568379	1(1)
AGOP	-4.174144	-4.323979	-3.580622	1(1)
GFCF	-3..639818	-4.296729	-3.568379	1(1)
ALAB	-5.151007	-4.296729	-3.568379	1(1)

Note: If t* ≤ ADF (Critical Values) = Unit root does not exist. Eviews 12 was used to generate the unit root test results.

Source: Authors Computation (2024)

4.3. LAG LENGTH SELECTION

The optimal lag length was estimated to determine the lag length of the analysis to be used in this study. Table 4 showed that the result of the optimal lag length selected is 1.

***Table 4*:** Optimal lag length result

Lag	LogL	LR	FPE	AIC	SC	HQ
0	-15.98871	NA	0.000744	1.309566	1.451011	1.353865
1	42.99408	101.6945*	2.38e-05	-2.137523*	-1.571745*	-1.960329*
2	48.23708	7.954885	3.166-05	-1.878419	-0.888308	-1.568329
3	55.62974	9.686937	3.74e-05	-1.767568	-0.353124	-1.324582

Note*: * points to the chosen lag order with respect to the criterion. Eviews 12 was used to generate the lag length selection*
LR: sequential modified LR test statistic (each test at 5% level)
FPE: Final prediction error
AIC: Akaike information criterion
SC: Schwarz information criterion
HQ: Hannan-Quinn information criterion

Source: *Authors Computation (2024)*

Following the same orders of integration, the autoregressive distributed lag (ARDL) technique becomes appropriate for estimating the relationship between the variables in this study. From the model estimated below**,** only one equation was produced: a static short-term equation. In addition, the equation was produced using the Akaike info-criterion and choosing a maximum lag of 1 for the dependent and independent variables. These equations are provided in the subsequent subsections.

4.4. ARDL SHORT-RUN COEFFICIENTS

Table 5 below presents the result of the short run coefficients of the analyzed ARDL model. The coefficient of determination (R^2) as well as the adjusted R-squared is 0.98. Since the model used in this study is a multiple regression model, the adjusted R-squared becomes a better measure. What this indicates is that 98% of variation in gross domestic product (GDP) is caused by a variation or better still is explained by the explanatory variables; agricultural output (AGOP), agricultural labour (ALAB) and capital (GFCF). The F-stats (0.0000), which measure the overall significance of the model, confirm that all the independent variables have significant influence on the dependent variable. Also, the Durbin Watson of 1.95 shows that there is no serial correlation associated with the regression result.

Furthermore, the coefficient of the natural logarithm of agricultural output (AGOP) indicates that it is positive and has a statistically significant effect on the economic growth in Nigeria in the short run; that is, as agricultural output increases, economic growth will also increase. From the table, it shows that a 1% increase in agricultural output will result in an 83.7% increase in gross domestic product. Similarly, a unit decrease in agricultural output will lead to a 43% decrease in economic growth. This however shows that agriculture is a viable source of economic growth in Nigeria. This result is in line with Awokuse and Xie (2014) and Oyinbo and Rekwot (2018).

On the other hand, the coefficient of the natural logarithm of agricultural labour (ALAB) is also positive and statistically significant at lag 1 in the short run. Therefore, what this indicates is that in the short run, labour has a statistically significant effect on the economic growth in Nigeria; that is, as agricultural labour increases, economic growth will also increase. As specified in the table below, a 1% increase in agricultural labour will result in a 45% increase in gross domestic product. Thus, agricultural labour is also important to economic growth. Nevertheless, the coefficient of the natural logarithm of gross fixed capital formation (GFCF) was negative and statistically insignificant. This indicates that a decrease in gross fixed capital formation will lead to a decrease in economic growth in Nigeria. This is also in line with the work of Kanu & Ozurumba (2014). They specified that in the short run, gross fixed capital formation had no significant impact on economic growth, but in the long run, the VAR model estimate indicates that gross fixed capital formation had positive long-run relationships with economic growth in Nigeria.

Further, the coefficient of the error correction term [ECT (-1)] is negative and statistically significant at the 5% level of significance. This further explains that the variables are cointegrated and there is a long-run relationship between the gross domestic product and the independent variables. In the short run, the relationship between the variables is negative and not statistically significant. However, the error correction term, which measures how quickly the variables return to their long-run equilibrium, is significant at a 5% level. Specifically, the estimated value of -

0.442869 (with a standard error of 0.119497) indicates that approximately 44% of the statistical gap between the variables is eliminated over the course of this study.

Table 5: Result of ARDL short run coefficient

Dependent Variable	LGDP				
Selected Model	ARDL (1, 1, 1, 0)				
Included Observations	31 after adjustments				
ARDL Short-run model					
Variables	Coefficient	Std. Error	t-statistics	Prob.	Remark
AGOP	0.837184	0.059765	14.00798	0.0000	Significant
AGOP(-1)	-0.430349	0.139648	-3.081663	0.0051	Significant
ALAB	-0.299593	0.228852	-1.810805	0.2029	Not significant
ALAB(-1)	0.450313	0.248681	-1.810805	0.0827	Significant
GFCF	-0.032206	0.085741	-0.375622	0.7105	Not significant
CointEq(-1)	-0.442869	0.119497	-3.706109	0.0011	Significant
R-squared	0.988943				
Adjusted R-squared	0.986179				
F-statistics	357.7664				
Prob(F-statistic)	0.000000				
Durbin-Watson stat	1.957379				

Source: Authors Computation (2024). Eviews 12 was used to generate the result of the ARDL short run coefficient

4.5. ARDL BOUND TEST

To determine if a long-run co-integration relationship exists between the agricultural sector and economic growth in Nigeria, the ARDL bound test was carried out. The result of the bound test is presented in table 6. According to the table, the calculated F-statistic (3.052277) is greater than k; therefore, the null hypothesis is rejected, and it is concluded that there is a long-run relationship between the variables. Therefore, the implication of this result is that agricultural output, labour and capital have a significant relationship with economic growth in the long run. Hence, both the short-run and long-run models will be considered since the variables show evidence of a long-run relationship, as indicated by the results from the bounds test within the study period.

Table 6: *Result of ARDL bounds test*

	Value	Significance	Lower Bound	Upper Bound
F-statistic	**3.052277**	10%	2.72	3.77
K	3	5%	3.23	4.35
		2.5%	3.69	4.89
		1%	4.29	5.61

Source: *Authors Computation (2024). Eviews 12 was used to generate the result of the ARDL bounds test result*

4.6. DIAGNOSTIC TEST RESULTS

For the purpose of this study, the five major diagnostic tests are carried out so as to make sure that the estimated model is accurate, reliable, and stable. These are residual normality**,** serial correlation test, heteroscedasticity test, specification test, and stability test. The results of these tests are presented in Table 7. From the result, since the probability that the residuals are normal (13%) was greater than the 5% critical level, then the null hypothesis is not true, and the residuals are normal. Likewise, for serial correlation, since the estimated probability of 15% is greater than the 5% critical level, there is no serial correlation in the residuals. Moreover, for heteroscedasticity, the Breusch-Pagan-Godfrey test was utilized. As stated above, since the probability value of 27% is greater than 5% critical level, the model is homoscedastic. Also, Ramsey's Regression Specification Test (RESET) checks whether variables have been omitted or incorrectly specified. From the table, the probability that is true is 11%, so since this probability is greater than the 5% critical level, we reject the null hypothesis of misspecification.

Table 7: *Diagnostic Testing*

Diagnostic F-tests	**Prob.**	**Remark**
Residual normality	0.130510	The residuals are normal
Serial Correlation	0.1529	No serial correlation in the residuals
Heteroscedasticity	0.2728	No heteroscedasticity in the model
Ramsey RESET	0.1112	The model is well specified

Source: *Authors Computation (2024). Eviews 12 was used to generate the results of the diagnostic tests*

Finally, the model stability was determined using the cumulative sum of recursive residuals (CUSUM and CUSUMSQ). This test clearly indicates stability in the estimated equation during the sample period. From figure 3, the estimated model parameters (represented by the blue lines) are found within the 5% critical lines. Therefore, the model is stable.

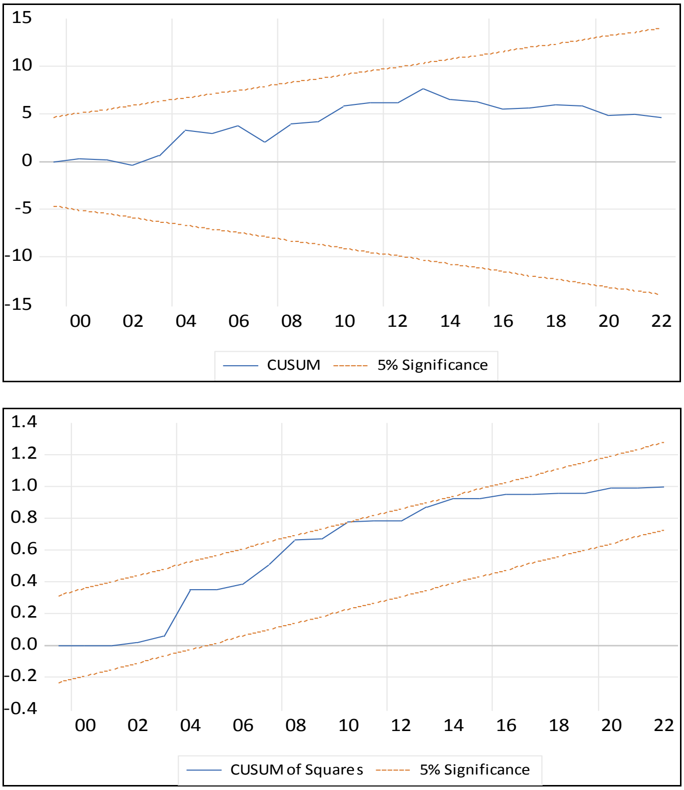

Figure 3 *CUSUM & CUSUMSQ for Stability within 5% critical lines.*

Therefore, since the accuracy, reliability, specification and stability of the ARDL model has been confirmed, the coefficients of the independent variable can be used to explain variations in economic growth in the year 1986 and 2019.

4.7. PAIRWISE GRANGER CAUSALITY TEST RESULTS

The Pairwise Granger Causality test results in table 8 show the various causal relationships among the variables. The most relevant of these relationships are those that are related to GDP which are presented in Table 8 as follows:

Table 8: *Granger Causality Result*

Pairwise Granger Causality Tests
Date: 06/23/24 Time: 12:20
Sample: 1991 2022
Lags: 2

Null Hypothesis:	Obs	F-Statistic	Prob.
LAGOP does not Granger Cause LGDPN	30	0.20968	0.8123
LGDPN does not Granger Cause LAGOP		1.26098	0.3008
LALAB does not Granger Cause LGDPN	30	4.58497	0.0201
LGDPN does not Granger Cause LALAB		0.15010	0.8614
LGFCF does not Granger Cause LGDPN	30	1.83495	0.1805
LGDPN does not Granger Cause LGFCF		0.39023	0.6810
LALAB does not Granger Cause LAGOP	30	5.11972	0.0137
LAGOP does not Granger Cause LALAB		0.29708	0.7456
LGFCF does not Granger Cause LAGOP	30	2.27827	0.1233
LAGOP does not Granger Cause LGFCF		0.68361	0.5140
LGFCF does not Granger Cause LALAB	30	0.16747	0.8467
LALAB does not Granger Cause LGFCF		3.51424	0.0452

Source: *Authors Computation (2024). Eview 12 was used to generate the result of the Granger causality test results*

The rule states that the probability of the F-statistic must be less than 0.05% (5% level of significance) to show a causal relationship. Therefore, the test of causality as revealed in the table above shows the absence of Granger causality between agricultural output (AGOP) and gross domestic product (GDPN), capital (GFCF) and gross domestic product (GDPN), as well as capital (GFCF) and agricultural output (AGOP). The probability values for these variables are 0.1823 and 0.3008, 0.1805 and 0.6810, 0.1233 and 0.5140, respectively. This means that they are all independent of each other and do not influence each other significantly. Therefore, no null hypothesis of no causality is accepted. However, a unidirectional causal relationship was revealed between agricultural labour (ALAB) and economic growth (GDP), agricultural labour (ALAB) and agricultural output (AGOP) as well as agricultural labour (ALAB) and capital (GFCF), respectively. Since their probability values are all significant at 5%, this implies that agricultural labour is a predictor of GDP, AGOP, and GFCF. Therefore, null hypothesis of no causality is rejected.

5. CONCLUSION AND POLICY IMPLICATIONS

The primary aim of this study is to assess the relationship between the agricultural sector and economic growth in Nigeria over the period 1991–2022. To achieve this, specific objectives were stated, which include examining the relationship between the agricultural sector and economic growth and investigating the causality effects between the agricultural sector and economic growth in Nigeria.

The study, however, made use of descriptive statistics and appropriate econometric technique (ARDL) to achieve the objectives. Also, the theoretical base of this study rested on the Solow-Swan neoclassical growth theory. Hence, the econometric model was specified with GDPN as the dependent variable, while total agricultural output (AGOP), agricultural labour (ALAB), and capital (GFCF) were the explanatory variables.

To achieve the first objective, the study started with the preparation of descriptive statistics that showed the mean value, maximum value, standard deviation, etc., followed by the estimation technique, of which the study made use of the ARDL method of estimation. The autoregressive distributed lag (ARDL) bound test revealed that the variables are co-integrated, meaning there is a long-run relationship between the agricultural sector and economic growth in Nigeria. The result of the ARDL technique adopted to examine the short-run coefficient of the agricultural sector also indicated that the variable considered explains 98% of the variation in economic growth of Nigeria. The F-stat (prob.) showed that the total variables were significant to the model. The Durbin-Watson statistics also indicated that there is no serial correlation in the model.

The empirical result revealed that the agricultural sector, specifically agricultural output (AGOP) and agricultural labour, measured using agriculture value added (ALAB), have a positive and highly significant impact on the growth of the economy in the short run, indicating that the agricultural sector, through its output and labour is an engine of economic growth. More specifically, every 1 percentage increase in agricultural output is expected to generate an 83.7% increase in economic growth in the short run. While that of labour, every 1 percentage increase leads to a 45% increase in economic growth in the short run.

Likewise, it can be concluded that the agricultural sector (agricultural labour) can be used to predict the economic growth of Nigeria, as shown by the result of the Granger causality. This finding further underscores the significance of the agricultural sector in driving economic growth in Nigeria, both in the short-term and long-term. Consequently, it is essential to implement policies that enhance the sector's performance and contribute to the country's overall economic development, most especially in the area of human capital development, since the agricultural sector (agricultural labour) is not only associated with positive growth but also granger cause improvements in the economy in terms of output and gross fixed capital formation. This result further collaborates with the work of Awoyemi et al. (2017). Finally, based on the analysis carried out using the bounds test, this study also concludes that a long-run relationship exists among all variables specified in the model.

Furthermore, the diagnostic test results also show that the model is normally distributed, free from serial correlation and heteroscedasticity. The stability of the model’s parameters was also examined using the plots of the cumulative sum of recursive residuals (CUSUM) and the cumulative sum of recursive residuals

(CUSUMSQ), of which the result of the CUSUM and CUSUMSQ stayed within the 5% percent critical line. This therefore indicates the constancy and stability of the regression estimates throughout the period covered by the study.

Lastly, in line with the research findings, it is evident that agricultural labor has a substantial impact on economic growth. Consequently, it is recommended that the government take deliberate steps to enhance human capital development in the agricultural sector. One approach to achieving this is through organizing vocational training programs and guidance sessions in all regions that focus on increasing the productivity of commercial farmers.

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