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Regression Analysis on the Impact of Agriculture, Industry and Service Sector on Economic Growth in Nigeria

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Abstract

This study investigates the impact of agriculture, industry, and the service sector on Nigeria's economic growth from 1990 to 2022, using data obtained from the Central Bank of Nigeria (CBN) Statistical Bulletin. Employing an Ordinary Least Squares (OLS) regression model, the research explores the contributions of these key sectors to Nigeria's Gross Domestic Product (GDP). The findings reveal that the industrial sector has a significant positive effect on GDP, emphasizing its crucial role in driving economic growth. The agricultural sector also contributes positively, though its impact is relatively modest, highlighting the need for modernization and investment to enhance productivity. Surprisingly, the service sector shows a statistically significant negative impact on GDP, contrary to its traditionally recognized role in economic expansion. This anomaly suggests underlying structural issues within the sector that require further investigation. The study's model explains approximately 59.65% of the variation in GDP, with no significant evidence of autocorrelation, heteroskedasticity, or multicollinearity affecting the results. Based on these findings, the study recommends targeted policy interventions to improve agricultural productivity, strengthen industrialization efforts, and

reform the service sector to foster balanced and sustainable economic growth in Nigeria.

Keywords: Agriculture sector, Industry, Service, Sector, Economic, Growth, Nigeria

INTRODUCTION

Nigeria, Africa's most populous nation and one of its largest economies, has experienced significant economic shifts in recent decades. Historically reliant on agriculture, a sector vital for employment, income, and food security, Nigeria has seen the rise of industrial and service sectors as key drivers of economic growth (Adegbite et al., 2020). While agriculture remains a cornerstone of the economy, contributing significantly to GDP and employment, it faces challenges such as outdated farming practices, poor infrastructure, limited access to credit, and the impacts of climate change, which constrain its growth potential (Eze, 2022). Industrialization, particularly fueled by the discovery of oil reserves, has led to substantial growth in manufacturing, mining, and construction. However, the industrial sector struggles with inadequate infrastructure, unreliable power supply, and policy inconsistencies, limiting its full potential. Government initiatives like the Nigeria Industrial Revolution Plan (NIRP) aim to address these challenges and stimulate growth in the sector (Olanrewaju & Akinpelu, 2021).

Similarly, the service sector, including finance, telecommunications, and hospitality, has thrived due to urbanization and technological advancements. This sector has played a crucial role in job creation, productivity enhancement, and innovation. Despite rapid growth, especially in the banking and telecommunications industries, challenges such as regulatory constraints, inadequate infrastructure, and skills gaps remain (Ndukwe, 2023). In response to these challenges, the Nigerian government has implemented various policies and reforms, such as the Economic Recovery and Growth Plan (ERGP) and the National Economic Empowerment and Development Strategy (NEEDS), aimed at fostering economic diversification and reducing dependency on oil (Ministry of Budget and National Planning, 2017). However, issues like corruption, insecurity, political instability, and inadequate social infrastructure continue to impede sustainable economic growth. This

study investigates the relative importance of the agriculture, industry, and service sectors in Nigeria's economic growth.

Literature Review

Agriculture

Agriculture has long been the foundation of Nigeria's economy, crucial for employment, income, and food security. However, the sector is dominated by smallholder farming with limited productivity due to outdated techniques and restricted access to modern inputs. Additionally, climate change and erratic weather patterns have further strained agricultural output. In response, government initiatives like the Agricultural Transformation Agenda (ATA) and the Anchor Borrowers' Program (ABP) aim to modernize farming and improve value chains (Oyekale & Ogunniyi, 2019).

Industry

Nigeria's industrial sector, significantly influenced by oil, encompasses manufacturing, mining, construction, and utilities, all contributing notably to GDP and employment. Despite its potential, the manufacturing sector faces challenges like inadequate infrastructure and inconsistent policies, hindering global competitiveness. To address these issues, government policies such as the Nigeria Industrial Revolution Plan (NIRP) focus on creating a supportive environment for industrial growth by improving infrastructure and regulatory frameworks (Adebayo et al., 2018).

Service Sector

The service sector has emerged as a major driver of Nigeria's economic growth, covering finance, telecommunications, trade, hospitality, education, and healthcare. Financial services have expanded through liberalization and regulatory reforms, though challenges remain, particularly in SME access to finance. Similarly, the telecommunications sector has grown rapidly, fostering connectivity and digital services but still facing issues like inadequate rural infrastructure. Continued development of this sector, along with embracing digitalization, is crucial for sustainable economic growth (Udoh et al., 2021).

Empirical Review

Adegboye and Olusegun (2020) conducted a study titled "Impact of Agriculture on Economic Growth in Nigeria," using data sourced from the Central Bank of Nigeria (CBN) and the National Bureau of Statistics (NBS) covering the years 1981 to 2018.

Applying the Ordinary Least Squares (OLS) regression method, they found that agricultural output significantly and positively influences Nigeria's GDP growth. The authors concluded that agriculture remains a crucial driver of economic growth in Nigeria and recommended enhancing agricultural productivity through modernization and increased investment in agricultural infrastructure.

Similarly, Bello and Akinola (2019) analyzed "Industrialization and Economic Growth in Nigeria," using data from the World Bank Development Indicators and CBN, covering 1980 to 2019. They employed the Autoregressive Distributed Lag (ARDL) model and discovered that industrial output positively impacts economic growth, particularly in the long run. They concluded that industrialization is vital for sustained economic growth in Nigeria and recommended implementing policies to support industrial sector development, including infrastructure improvement and regulatory reforms.

Chukwuma and Nnadi (2021), in their study "Service Sector Contribution to Economic Growth in Nigeria," utilized data from the NBS and World Bank from 1990 to 2020. Using the Vector Error Correction Model (VECM), they found that the service sector significantly and positively impacts GDP, driven by finance, telecommunications, and trade services. They concluded that the service sector is a major contributor to Nigeria's economic growth and recommended policies to promote service sector growth through enhanced digital infrastructure and financial services.

Daniel and Okafor (2020), in their study "Agriculture, Industry, and Services: Their Role in Economic Growth in Nigeria," used data from the International Monetary Fund (IMF) and CBN, covering 1985 to 2020. Employing the Co-integration and Error Correction Model (ECM), they found that all three sectors significantly contribute to GDP, with the service sector having the highest impact, followed by industry and agriculture. The authors concluded that a balanced growth strategy involving all sectors is essential for Nigeria's economic development and recommended formulating integrated policies to support the simultaneous growth of agriculture, industry, and services.

Eze and Ajayi (2019), in their study "Economic Growth and Sectoral Contributions in Nigeria," analyzed data from the CBN and NBS from 1990 to 2018 using the Generalized Method of Moments (GMM). They found that while the industry's contribution to GDP is significant, it fluctuates due to policy inconsistencies. They concluded that stability in industrial policies could enhance the sector's contribution to

economic growth and recommended ensuring policy consistency and supporting industrial diversification.

Fagbemi and Oladipo (2019), in their study "Role of Agriculture and Industry in Nigeria's Economic Growth," used data from the Food and Agriculture Organization (FAO) and CBN from 1980 to 2019 and employed the Structural Vector Autoregression (SVAR) method. They found that both agriculture and industry positively impact GDP, with industry having a stronger effect. The authors concluded that while industrial development is crucial, improvements in agriculture should not be neglected, and they recommended balancing investments between agriculture and industry to achieve sustainable growth.

George and Ibrahim (2020), in their study "Sectoral Analysis of Economic Growth in Nigeria," used data from the World Bank and NBS from 1995 to 2020 and employed Panel Data Analysis. They found that the service sector has the highest contribution to GDP growth, followed by the industry and agriculture sectors. They concluded that the service sector is pivotal for Nigeria's economic expansion and recommended investing in human capital development to sustain service sector growth.

Hassan and Uche (2021), in their study "The Impact of Sectoral Output on Economic Growth in Nigeria," used data from the CBN and World Bank from 1981 to 2020 and employed Multiple Regression Analysis. They found significant positive impacts of agriculture, industry, and services on economic growth, with the service sector leading. The authors concluded that diversification across sectors enhances economic resilience and recommended implementing policies that encourage sectoral diversification and innovation.

Ikenna and Uzochukwu (2019), in their study "Industrial Output and Economic Growth in Nigeria," used data from the NBS and IMF from 1990 to 2019 and employed Co-integration and Granger Causality Tests. They found that industrial output is a significant determinant of economic growth, with long-term positive effects. The authors concluded that industrialization is a key driver of sustainable economic growth and recommended enhancing industrial capacity through infrastructure development and technology adoption.

Finally, Kelechi and Olayinka (2021), in their study "Evaluating the Role of Services in Nigeria's Economic Growth," used data from the World Bank and CBN from 2000 to

2020 and employed Dynamic Panel Data Analysis. They found that the service sector significantly contributes to GDP, particularly through finance and telecommunications. The authors concluded that the service sector is a crucial engine of economic growth and recommended supporting its expansion through regulatory reforms and investment in digital infrastructure.

METHODS

In order to investigate the impact of agriculture, industry and service sector on economic growth in Nigeria, Ordinary least (OLS) multiple regression method was adopted to analyse the secondary data generated between 1990 and 2022. The data generated for analysis were obtained from on-line Central Bank of Nigeria (CBN) Statistical Bulletin series.

The primary specification of the model that was tested in the study is as follows:

$$Y_i = \beta_0 + \sum_{j=1}^{p} \beta_j x_j + \varepsilon_i \quad (1)$$

Y_i *is the dependent variable,* β_0 *is the intercept of the model,* x_j corresponds to the *jth* explanatory variable of the model (*j = 1 to p*), and ε_i is the random error with expectation 0 and variance σ^2.

Hence**,**

$$GDP = f\left(AGR, IND, SER\right) \quad (2)$$

The econometric form of the model is therefore given as:

$$GDP = \beta_0 + \beta_1 AGR + \beta_2 IND + \beta_3 SER + \varepsilon \quad (3)$$

where; *GDP* = gross domestic product; AGR = *Agricultural GDP;* IND = Industrial GDP; SER = the Service GDP; β_0 = the equation's constant; β_1 = the coefficient of Agricultural sector; β_2 = the coefficient of Industrial sector; B_3 = the coefficient of Service sector; ε = is the error term of the equation.

Diagnostics Measures

Autocorrelation

Durbin-Watson Test

Durbin-Watson is a test statistic used to detect the presence of autocorrelation at lag 1 in the residuals (prediction error) from a regression analysis. It is named after James Durbin and Geoffrey Watson. The small sample distribution of the ratio was derived by John Von Neumann (Von Neumann, 1941). Durbin and Watson (1950, 1951) applied this.

$$d = \frac{\sum_{i=2}^{n}\left(e_i - e_{i-1}\right)^2}{\sum_{i=1}^{n}\left(e_{i-1}\right)^2} \tag{4}$$

where; e_i = residual for the observation (i); e_{i-1} = residual from the previous observation in the dataset.

Multicollinearity Test

This refers to the presence of high significant correlation among dependent variable in a system. The presence of this can lead to misleading result(s). To test for it, this research used the variance inflation factor (VIF) which measures the intensity of the collinearity in the system. If the value of the VIF is not more than 10, then the model estimated is free of multicollinearity.

The VIF is given by

$$VIF = \frac{1}{1-R^2} \tag{5}$$

The conditions for Multi-collinearity are:

If VIF = 1, for all variables the variables are not correlated.

If VIF > 4 (threshold suggest 10), then there is need to check the impact of multi-collinearity using correlation matrix.

Normality Test

To validate the assumption of normally distributed residuals, we use the Jarque-Bera test. This test assesses whether the residuals have skewness and kurtosis matching a normal distribution. The Jarque-Bera test statistic is calculated as:

$$JB = \frac{n}{6}\left(S^2 + \frac{(K-3)^2}{4} \right) \quad (6)$$

Where n is the sample size, S is the skewness, and K is the kurtosis of the residuals

Test for Homoscedasticity

The Breusch-pagan test is used to determine whether or not heteroscedasticity is present in a regression model.

The test statistic is derived from

$$LM = n \times R^2 \quad (7)$$

Where; LM is the Langrange multiplier statistic; n is the sample size; R^2 is the coefficient of determination from the auxillary regression of squared residuals on the independent variables.

RESULTS

Descriptive Statistics

Table 1: Descriptive statistics

	GDP	IND	SER	AGR
Mean	4.296100	10567.48	12019.58	23478.95
Maximum	15.32916	41126.06	55300.97	77100.63
Minimum	-2.035119	106.6267	117.1267	127.6267
Std. Dev.	3.956335	11575.98	14252.59	26483.70
Skewness	0.459608	1.111372	1.420698	0.825905
Kurtosis	3.392193	3.317954	4.350087	2.152563
Jarque-Bera	1.373312	6.932322	13.60736	4.739107
Probability	0.503256	0.031237	0.001110	0.093522
Observations	33	33	33	33

Table 1 summarizes the descriptive statistics for GDP, industry (IND), services (SER), and agriculture (AGR) based on 33 observations. The data reveals that the average GDP growth rate is approximately 4.3%, with sector outputs averaging 10,567.48 units for industry, 12,019.58 units for services, and 23,478.95 units for agriculture. The substantial

range in values for each variable highlights significant variability, particularly in agriculture, where outputs fluctuate between 127.63 and 77,100.63 units. This variability is further emphasized by the standard deviations, with industry, services, and agriculture displaying substantial dispersion around their means, indicating considerable instability in these sectors.

The distributional characteristics, as indicated by skewness and kurtosis, show that all variables are positively skewed, with a concentration of lower values and longer right tails, particularly in the service sector, which exhibits the highest skewness (1.42). The kurtosis values suggest different distribution shapes, with GDP and industry displaying moderate peakedness, while services show a more pronounced peak and heavier tails, indicating a leptokurtic distribution. In contrast, agriculture shows a flatter, platykurtic distribution. The Jarque-Bera test results indicate that while GDP's distribution is approximately normal (p = 0.5033), the industry and service sectors deviate significantly from normality, with agriculture showing marginal non-normality.

Table 2: Regression Analysis result for the LGDP with sectorial contributions

Variable	Coefficient	Std.Error	t-Statistic	Prob
C	1.664748	0.383943	4.335923	0.0002
AGR	1.20E-05	6.37E-05	0.187640	0.0227
LNIND	0.018784	0.009385	2.001405	0.0068
SER	-5.78E-05	2.37E-05	-2.443372	0.0223
R-squared	0.596472	Durbin-Watson stat		1.950476
Adjusted R-squared	0.508531			
F-statistic	3.371261			
Prob(F-statistic)	0.001995			

Table 2 shows the results on the regression analysis on the sectoral contributions to Nigeria's economic growth, with the logarithm of GDP (LGDP) serving as the dependent variable. The constant term exhibits a statistically significant coefficient (p = 0.0002), suggesting a robust baseline effect on GDP, independent of the sectoral inputs. This result indicates an inherent upward trajectory in economic growth, even in the absence of sector-specific contributions.

For the agricultural sector (AGR), the estimated coefficient (1.20E-05) is positive and statistically significant (p = 0.0227), albeit modest in magnitude. This finding highlights the sector's positive, albeit limited, impact on GDP, consistent with its longstanding role in the Nigerian economy. The industrial sector (LNIND) presents a more substantial and statistically significant coefficient (0.018784, p = 0.0068), indicating a more pronounced

contribution to economic growth. The significance of this coefficient underscores the critical importance of industrial development in bolstering Nigeria's GDP, in line with economic growth theories that emphasize industrialization as a key driver of sustained economic progress.

Conversely, the service sector (SER) yields a negative coefficient (-5.78E-05), which is statistically significant (p = 0.0223). This result suggests that the sector's expansion may be exerting a marginally adverse effect on GDP, potentially due to inefficiencies or structural constraints within the sector. The model's R-squared value of 0.596 implies that approximately 59.65% of the variation in Nigeria's GDP is accounted for by the combined contributions of the agriculture, industry, and service sectors. The statistical significance of the F-statistic (p = 0.001995) further confirms the collective relevance of these sectors to GDP growth. Additionally, the Durbin-Watson statistic of 1.950476 indicates that the residuals are free from significant autocorrelation, thereby affirming the reliability of the estimated coefficients.

Post Estimation Analysis

Table 3: Heteroskedasticity Test: White

F-statistic	1.181871	Prob. F(9,18)	0.3627
Obs*R-squared	10.40029	Prob. Chi-Square(9)	0.3191
Scaled explained SS	13.82126	Prob. Chi-Square(9)	0.1288

The results in Table 3 presents the results of a White test for heteroskedasticity, which is used to detect whether the variance of the errors in a regression model is constant or varies (i.e., whether heteroskedasticity is present).

The Prob. F(9,18) value of 0.3627 suggests that the null hypothesis of homoskedasticity (constant variance of the error terms) cannot be rejected at conventional significance levels (p = 0.05). This indicates that there is no statistically significant evidence of heteroskedasticity in the model. Therefore, the assumption of homoskedasticity, which is important for the validity of standard error estimates and the overall reliability of the regression results, holds in this context.

Table 4: Multicollinearity test

Variable	Coefficient Variance	Uncentered VIF	Centered VIF
C	0.147412	2.997735	NA
AGR	4.06E-09	5.10246	0.37849
LNIND	8.81E-05	4.56663	1.27373
SER	5.59E-10	3.42477	1.28300

Table 4 presents the results of the multicollinearity test, focusing on the centered Variance Inflation Factor (VIF) values, which are key indicators of the degree of multicollinearity among the independent variables in the regression model. The centered VIF for Agriculture (AGR) is 0.37849, significantly below the conventional threshold of 10, indicating minimal multicollinearity with other variables. This low VIF value suggests that the coefficient estimates for agriculture are unlikely to be inflated by correlations with other predictors, thereby ensuring their reliability. Similarly, the Industry variable (LNIND) shows a centered VIF of 1.27373, which is well within the acceptable range. This result implies that the industry sector's variable does not exhibit significant multicollinearity, further reinforcing the reliability of its coefficient estimates. The absence of strong linear relationships with other independent variables means that the industry sector's impact on the dependent variable can be estimated with confidence. The Service sector (SER) also exhibits a centered VIF of 1.28300, comfortably below the threshold. This indicates that the service variable is not significantly collinear with other variables in the model, allowing for stable and accurate estimation of its effect on the dependent variable without substantial distortion from multicollinearity.

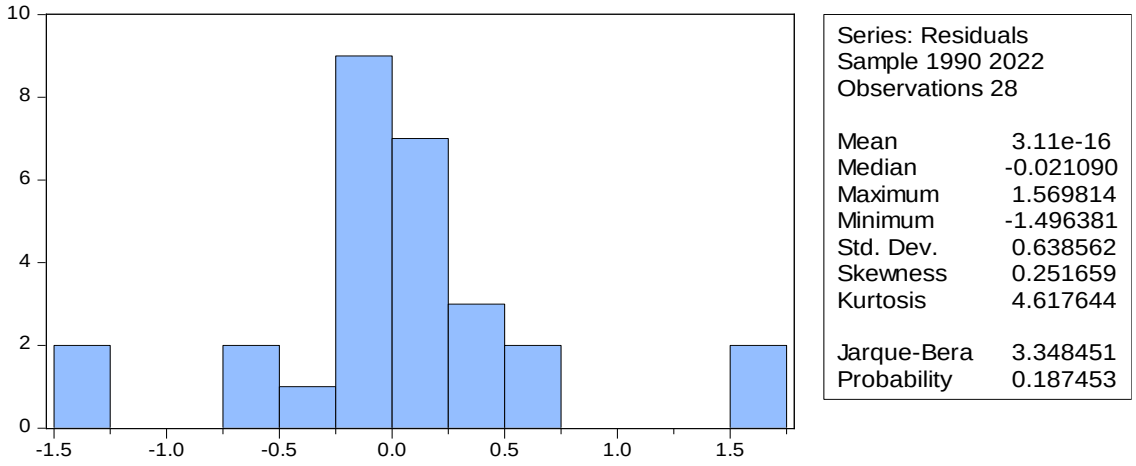

Figure 1: Normality plot of the Residual

Figure 1 presents the normality plot of the residual, the plot reveals Jarque-Bera statistic of 3.348451 with its corresponding p-value of 0.1874553. This implies that the residuals is normally distributed, since the p-values is greater 0.05 level of significance.

DISCUSSION

The analysis of Nigeria's GDP in relation to the agriculture, industry, and service sectors offers insights that both align with and challenge existing literature. The agricultural sector, characterized by high variability in output due to factors like fluctuating weather conditions and infrastructure deficits, continues to have a modest yet positive impact on GDP. This finding supports Adegboye and Olusegun's (2020) conclusion that agriculture remains vital to Nigeria's economic growth, despite its susceptibility to external shocks. The study reinforces the need for modernization and investment in agricultural infrastructure to amplify the sector's contribution to the economy.

Similarly, the industrial sector's positive and statistically significant effect on GDP underscores its importance as a key driver of economic growth, echoing the findings of Bello and Akinola (2019). The significance of this sector highlights the necessity for policies that enhance industrial infrastructure, stabilize power supply, and foster innovation to sustain and accelerate economic progress. However, the service sector presents a notable divergence from the literature. Contrary to previous studies, which found the service sector to be a significant positive contributor to GDP, this analysis reveals a slight adverse effect on economic growth. This unexpected result suggests inefficiencies within the sector,

warranting further investigation and potential policy reforms to address underlying challenges.

CONCLUSION

This study examined the contributions of agriculture, industry, and service sectors to Nigeria's GDP growth, revealing their varied impacts. Agriculture, despite its significant variability due to external factors like weather and infrastructure, continues to play a positive role in the economy. However, its modest contribution suggests that its potential is not fully realized, underscoring the need for greater investment and modernization to boost productivity and resilience.

The industrial sector emerged as a key driver of economic growth, with a substantial and statistically significant impact on GDP. This finding highlights the importance of policies that support industrial development, such as improving infrastructure, enhancing the business environment, and fostering innovation, all crucial for sustaining and accelerating growth.

Contrary to expectations, the service sector showed a slight negative impact on GDP, suggesting the presence of inefficiencies or structural issues. This surprising result calls for a reassessment of the sector, focusing on identifying and addressing the factors contributing to its adverse effect on economic growth. Reforms aimed at improving regulation, service delivery, and overall efficiency could help transform the service sector into a more effective contributor to the economy.

Recommendations

Based on the findings, the following are recommended

i. Implement modern farming techniques, improve infrastructure, increase access to credit, and address climate change impacts to boost the agricultural sector's contribution to GDP.

ii. Invest in infrastructure, ensure a reliable power supply, and maintain consistent policy frameworks to harness the full potential of the industrial sector for economic growth.

iii. Conduct a thorough investigation into the underlying issues affecting the service sector and implement targeted reforms to address performance gaps and enhance its positive contribution to GDP.

iv. Formulate and implement comprehensive policies that support the balanced growth of agriculture, industry, and services to promote sustainable and inclusive economic development.

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