Unveiling the Asymmetrical Nexus: Rice Production and Economic Growth in Nigeria

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Abstract—**This study explores the relationship between rice production and economic growth in Nigeria from 1980 to 2022. Using data from the Food and Agricultural Organization (FAO), the research employs econometric analysis to investigate the dynamic relationship between rice production (RP), overall agricultural production (AGP) and Gross Domestic Product (GDP). The findings reveal an asymmetrical relationship between the variables, indicating that advancements in rice yield capacity have the potential to significantly contribute to economic growth. The study recommends investing in agricultural infrastructure, such as irrigation systems, storage facilities, and modern farm equipment, to enhance efficiency and productivity in the rice sector. The results suggest that prioritizing rice production can unlock its full potential and contribute to economic growth. The study's findings provide valuable insights for policymakers and stakeholders seeking to promote sustainable agricultural development and economic growth in Nigeria.**

Index Terms—**Rice Production; Agricultural Growth; Economic Development; VAR Model and Nigeria.**

I. INTRODUCTION

Rice, a versatile and nutritious grain, serves as a primary source of calories for billions of people across the globe, particularly in Asia and Africa (Aslam et al., 2022). Rice's exceptional adaptability to varied climatic conditions and its rich nutritional profile have cemented its status as a vital component of global food security, particularly in densely populated countries like China, India, Indonesia, and Bangladesh, where it serves as a primary food source for over half of the world's population. As a staple food, rice plays a critical role in ensuring food availability and access in these regions, highlighting its significance in sustaining global food systems. With its widespread cultivation and consumption, rice's importance extends beyond its nutritional value, underscoring the need for continued research, production, and distribution efforts to meet the escalating demands of a growing global population and mitigate potential food insecurity risks. (Aslam et al., 2022). Rice production extends its significance beyond food security, exerting a profound impact on the global economy through its substantial contributions to employment generation, international trade, income creation, and economic growth in diverse regions. As a major crop, rice production provides livelihoods for millions of smallholder farmers, laborers, and rural communities, stimulating local economies and fostering poverty reduction. Furthermore, rice trade facilitates global economic exchange, with major exporters like Thailand, Vietnam, and India playing a crucial role in shaping international markets. The crop's economic influence also permeates related industries, such as processing, storage, and transportation, generating additional income streams and driving economic growth in rice-producing countries, thereby underscoring the importance of rice production as a vital economic driver in many regions. (Singh et al., 2010).

The intricate relationship between rice production and economic growth has garnered significant attention globally, with various studies highlighting the crop's pivotal role in shaping the economic fortunes of numerous countries (FAO, 2020; IRRI, 2019). At the global level, rice is a staple food for over 3.5 billion people, with Asia being the largest producer and consumer (FAO, 2020). The crop's economic significance extends beyond food security, influencing employment, trade, income creation, and economic growth in diverse regions (IRRI, 2019). Globally, the average rice yield per hectare sits at 4.25 metric tons. However, significant disparities exist between leading producers. China, the world's largest rice producer, boasts a yield of 6.5 metric tons per hectare, followed

by Indonesia (5.1 metric tons) and India (4.3 metric tons) (Aslam et al., 2022). Conversely, Nigeria's rice productivity falls short at just 2.0 metric tons per hectare. This figure lags behind not only the global average but also major rice-producing countries like Egypt (2.8 metric tons) despite exceeding Egypt's total production (Jayne et al., 2014). The global trend reflects a growing emphasis on domestic rice production for food security and economic development. Many countries are actively working to enhance their rice production capabilities, aiming for self-sufficiency and even export potential. This strategy aligns with the understanding that increased rice production contributes to a nation's GDP and overall development (Singh et al., 2010). In stark contrast, Nigeria, despite its efforts, has seen a steady rise in rice imports (Aregbesola & Makinde, 2020).

The burgeoning significance of rice in Africa's agricultural landscape is exemplified by the continent's impressive 15% production increase between 2010 and 2018 (Africa Rice, 2020). Nigeria, as the continent's most populous nation, has emerged as a pivotal player in Africa's rice economy, with the crop assuming a vital role in the country's food security and economic development paradigm (CBN, 2019). The Nigerian government's concerted efforts to promote self-sufficiency in rice production, coupled with initiatives aimed at enhancing productivity and competitiveness, have contributed to the crop's growing importance in the national agenda (FMARD, 2016). As a result, rice has become an integral component of Nigeria's agricultural transformation strategy, with far-reaching implications for employment generation, income creation, and economic growth in rural areas (IFAD, 2019). The crop's ascendancy in Nigeria's agricultural sector underscores the need for sustained investments in research, extension services, and infrastructure development to ensure the long-term viability and sustainability of the country's rice economy.

Nigeria holds a significant position within the Economic Community of West African States (ECOWAS), a region with a projected fast-growing rice industry. Notably, Nigeria accounts for 23% of the region's volume growth in net rice imports, reflecting a persistent gap between domestic rice production and consumption (International Food Policy Research Institute, 2019). While the country demonstrates progress in terms of harvested rice area (37% of regional gain), rice output (23% of regional gain), and annual production expansion (1.75%), these gains are primarily driven by increases in area harvested (0.97%) rather than yield improvements (0.76%) (International Food Policy Research Institute, 2019). Additionally, Nigeria contributes 23% of the region's volume growth in rice consumption, fueled by a population growth of 2.48% with only a slight increase in per capita consumption (2.83% annual expansion) (International Food Policy Research Institute, 2019). While prior research in Nigeria has explored various aspects of rice production, including import trends, price disparities, and their implications for food security (Aregbesola & Makinde, 2020; Jayne et al., 2014), a critical gap remains. Existing studies haven't specifically examined the direct contribution of rice production to Nigeria's economic growth. The aims of this research is to bridge this gap by investigating the influence of rice production on the economic growth of Nigeria.

Nigeria's rice sector, despite its vast potential, is beset by a myriad of challenges that have stifled its growth and productivity. Principal among these challenges are low yields, limited access to credit facilities and essential inputs, and inadequate infrastructure, including storage facilities, processing equipment, and transportation networks (IFAD, 2019). These constraints have resulted in high production costs, reduced competitiveness, and diminished economic returns for rice farmers, thereby hindering the sector's contribution to Nigeria's economic growth and food security (FMARD, 2016). Furthermore, the lack of modernized farming practices, insufficient irrigation facilities, and inadequate extension services have exacerbated the sector's vulnerabilities, underscoring the need for a comprehensive understanding of the intricate relationships between rice production, productivity, and economic growth in Nigeria (Ogundele et al., 2020). Elucidating these dynamics is crucial for devising effective strategies to address the sector's challenges and unlock its full potential for economic development and poverty reduction.

This study aims to unveil the asymmetrical relationship between rice production and economic growth in Nigeria, exploring the crop's impact on employment, income creation, and economic expansion. By examining the complex dynamics between rice production and economic growth, this research seeks to contribute to the development of

evidence-based policies and strategies to enhance the productivity and competitiveness of Nigeria's rice sector.

Specifically, this study makes a significant contribution to the extant literature by employing advanced econometric techniques to investigate the nexus between rice production and economic growth in Nigeria, thereby providing fresh insights into this crucial relationship. Furthermore, it undertakes a distinctive examination of the underlying factors responsible for the disparities in rice productivity between Nigeria and other prominent rice-producing nations, identifying key areas for improvement. Ultimately, the study offers a set of evidence-based policy recommendations designed to enhance the efficiency of rice production in Nigeria, thereby unlocking its full potential to drive economic growth, stimulate rural development, and ensure food security. By addressing these critical knowledge gaps, this research provides a valuable resource for policymakers, researchers, and stakeholders seeking to revitalize Nigeria's rice sector and harness its potential for sustainable economic development.

The remainder of this paper is structured as follows. The next section provides a comprehensive review of relevant literature on rice production, its impact on economic growth, and the specific context of rice production in Nigeria. Following the literature review, the methodology section details the data employed, the econometric techniques used, and the model specification. The results section will present the findings of the analysis, followed by a discussion section that interprets the results and explores their implications. The final section concludes the paper, summarizing the key findings, highlighting their significance, and suggesting areas for future research.

II. LITERATURE REVIEW

This literature review synthesizes the extant body of knowledge on the intricate relationship between rice production and economic growth, with a specific focus on the Nigerian context. Drawing on a diverse range of theoretical and empirical studies, this review aims to critically examine the existing evidence on the dynamics of rice production, productivity, and its impact on economic growth, as well as the factors influencing rice production efficiency in Nigeria. By scrutinizing the methodological approaches, findings, and policy implications of previous research, this review seeks to identify knowledge gaps, contradictions, and areas for further investigation, thereby providing a comprehensive foundation for the subsequent empirical analysis and policy recommendations.

According to a comprehensive study conducted by Singh et al. (2021), titled "Growth Performance and Profitability of Rice Production in India: An Assertive Analysis," a rigorous compound growth rate analysis revealed a positive growth trajectory in rice production in India during the study period. The findings indicate a significant upward trend in rice production, underscoring the sector's resilience and potential for sustained growth. Notably, the study's assertive analysis employed a robust methodological framework, providing credible insights into the dynamics of rice production in India. The positive growth rate observed in the study can be attributed to various factors, including improved agricultural practices, technological advancements, and favorable policy initiatives. These findings have important implications for policymakers, researchers, and stakeholders in the agricultural sector, highlighting the need for continued investments in rice research, development, and innovation to further enhance productivity and profitability in the sector. Similarly, Abah et al. (2021) conducted a study examining the impact of rice production on agricultural growth in Nigeria, utilizing a dataset spanning four decades (1981-2020). Employing a Vector Error Correction Model (VECM) in conjunction with descriptive and inferential statistical analyses, the researchers uncovered a noteworthy paradox: while the growth rate of rice production exhibited a positive trajectory, with an average annual growth rate of 4.2%, the sector's overall growth momentum remained stagnant. This suggests that despite the upward trend in rice production, the sector's growth was not sufficient to drive broader agricultural growth in Nigeria. The study's findings highlight the need for policymakers to reexamine the rice production sector's dynamics and implement targeted interventions to revitalize growth and unlock its potential for contributing to Nigeria's agricultural development. Also, Arief (2021) undertook a comprehensive investigation into the dynamics of the rice market's impact on GDP growth in five major Asian economies: India, China, Indonesia, Vietnam, and Bangladesh. Employing the

Granger causality method, the study revealed a significant finding: the growth of gross domestic product (GDP) was more substantially influenced by rice production rather than rice consumption. This suggests that the cultivation and production of rice have a more pronounced impact on the overall economic performance of these countries, as opposed to the demand and consumption of rice. The study's results imply that policies and initiatives aimed at enhancing rice production, such as investments in agricultural infrastructure and technology, may have a more significant impact on GDP growth than those focused solely on stimulating rice consumption. This insight has important implications for policymakers seeking to leverage the rice sector as a driver of economic growth and development in these nations. In addition, Chebbi and Lachaal's (2007) empirical investigation in Tunisia probed the nexus between the agricultural sector (including rice production) and economic growth, leveraging a Vector Autoregressive (VAR) model to analyze data spanning 1961-2005. Their findings revealed a statistically significant long-run equilibrium relationship between the agricultural sector and other economic sectors, underscoring the interconnectedness of Tunisia's economy. This suggests that fluctuations in the agricultural sector have a ripple effect on the broader economy, and conversely, that economic growth has a positive impact on the agricultural sector. The study's results have important implications for policymakers, highlighting the need for a holistic approach to economic development that recognizes the interdependencies between sectors. By elucidating these relationships, Chebbi and Lachaal's research contributes to a deeper understanding of the Tunisian economy's dynamics and informs strategies for sustainable economic growth.

Moreover, Sertoglu, et al, (2017), investigated the impact of the agricultural sector on Nigeria's economic growth, utilizing a Vector Error Correction Model (VECM) to analyze data from 1981 to 2013. Their findings revealed a significant long-run equilibrium relationship between real GDP, agricultural output, and oil rents, indicating that these variables converge to a stable equilibrium in the long term. This suggests that the agricultural sector plays a crucial role in Nigeria's economic growth, and that shocks to agricultural output have a lasting impact on the overall economy. Furthermore, the study's results imply that

oil rents, often considered a curse for economic development, can also contribute to economic growth when leveraged effectively. The research provides valuable insights for policymakers seeking to diversify Nigeria's economy and promote sustainable growth, highlighting the need to prioritize agricultural development and effective management of oil revenues. Subsequently, Gautam and Yu's (2015) comparative study of China and India's agricultural productivity growth and drivers employed a multifaceted analytical framework, utilizing data from 1980 onwards. The research revealed that both countries have achieved impressive total factor productivity (TFP) growth, exceeding 2% annually in China and 1-2% in India, primarily driven by technological advancements. However, efficiency improvements have stagnated or declined. Notably, the study highlighted regional disparities, with China's North and Northeast, and India's South and East, experiencing faster growth. These findings underscore the critical role of productivity growth in ensuring long-term food security, particularly in resource-constrained economies. In a related study, Turan (2006) investigated the relationship between agricultural output growth and GDP in North Cyprus, employing Granger causality tests. The results showed bidirectional causality, indicating that agricultural growth drives economic growth, and vice versa. This suggests that agricultural development is intricately linked with broader economic performance, emphasizing the need for policymakers to prioritize agricultural productivity growth and technological innovation to foster sustainable economic development. In another research, Dua and Garg's (2020) comprehensive sectoral analysis of productivity in Asia-Pacific economies, spanning 1980-2014, employed advanced econometric techniques, including panel unit root tests, co-integration, and group-mean FMOLS. Their findings revealed that capital deepening, government size, institutional quality, productivity spillovers, and financial openness have a significant impact on productivity across all sectors. However, the effects of human capital and trade openness vary across sectors in developing economies, highlighting the need for nuanced policy approaches. In a related study, Olomu et al. (2020) conducted a review of Nigeria's agricultural sector value chain and government policy interventions, concluding that recent initiatives have

yet to yield substantial solutions to the sector's challenges. This underscores the importance of effective policy design and implementation to address the complex issues hindering agricultural development in Nigeria. Together, these studies emphasize the need for policymakers to adopt a multifaceted approach, considering both sector-specific and economy-wide factors, to foster productivity growth and drive sustainable development in the agricultural sector.

Rice, a staple food for more than 50% of the world's population, has a significant impact on global food security and economic development, (Aslam et al. 2022). Its influence goes beyond food security and extends to job creation, trade dynamics, income generation, and overall economic growth across various regions, (Singh et al. 2010). This review of literature delves into the existing scholarship on the nexus between rice production and economic growth, with a particular focus on the case of Nigeria.

2.1 Positive Relationship between Rice Production and Economic Growth

A substantial body of research demonstrates a direct correlation between rice production and economic growth. Studies in India (Singh et al., 2021; Dey, 2020; Sayeed & Yunus, 2018), Vietnam (Maita et al., 2020), Bangladesh (Dey, 2020; Sayeed & Yunus, 2018; Alarm & Islam, 2013), and Thailand (Akrasanee & Wattananukit, 1976) consistently demonstrate this positive correlation. These studies employ diverse methodologies, including compound growth rate analysis (Singh et al., 2021), Vector Error Correction Models (VECM) (Abah et al., 2021), Granger causality (Arief, 2021), Fully Modified Least Squares and Dynamic Least Squares. That is (FMOLS) and (DOLS) respectively. (Dey, 2020), Ordinary Least Squares (OLS) (Rahman et al., 2017; Alarm & Islam, 2013), and descriptive statistics (Akrasanee & Wattananukit, 1976).

The findings consistently reveal that increased rice production contributes to a nation's GDP growth. Dey (2020) in Bangladesh and Maita et al. (2020) in Vietnam highlight the significant contribution of rice production to GDP, even exceeding the impact of other agricultural sectors like fisheries (Dey, 2020). Similarly, Sayeed & Yunus (2018) emphasize the dominant role of rice production in driving economic growth in Bangladesh. This positive association can be attributed to several factors. Increased rice production often translates to higher income for farmers, stimulating rural demand and contributing to overall economic activity (Singh et al., 2010). Additionally, rice production can generate export opportunities, fostering foreign exchange earnings and further boosting economic growth (Kang, 2015; Hegde & Hegde, 2013).

2.2 Divergent Findings and the Nigerian Context

While the dominant narrative suggests a positive correlation between rice production and economic growth, some studies present contrasting evidence. Bhandari et al. (2017) in Nepal showed no significant correlation between production of rice and growth of the economy, using decomposition analysis. This suggests that other factors beyond rice production may play a more prominent role in determining economic growth in that specific context.

The case of Nigeria presents a unique situation. Despite being the largest rice producer in Africa (International Food Policy Research Institute, 2019), Nigeria also holds the dubious distinction of being the continent's biggest rice importer (Aregbesola & Makinde, 2020). This paradox necessitates a closer examination of the factors impeding the translation of Nigeria's rice production into tangible economic growth. Research by Biam & Adejo (2017) suggests that high rice import rates can have a detrimental effect on the domestic rice production sector and the national economy. Additionally, studies by Okezie & Ihebuzoaju (2017) and Odetola & Etumnu (2013) highlight the broader role of agriculture in contributing to Nigeria's GDP growth. These findings suggest that while agriculture plays a significant role, the specific contribution of rice production within the Nigerian agricultural sector might require further investigation. This review of relevant literature underscores the established positive correlation between production of rice and growth of the economy in various countries. However, Nigeria's case presents a unique challenge.

2.3 Gaps in Knowledge and the Current Study's Contribution

The existing literature provides important insights into the correlation between rice production and economic growth. However, several gaps remain. First, limited research has delved into the specific reasons behind

the disconnect between Nigeria's rice production its economic growth. Second, most studies employ methodologies that may not fully capture the complexities of the relationship in the Nigerian context.

This current study aims to address these gaps. We intend to employ econometric techniques to analyze the relationship between production of rice and the Nigeria's economic growth. The study will investigate the potential causes of the observed disparities in rice productivity between Nigeria and other major rice-producing countries. Furthermore, the research will propose policy recommendations aimed at enhancing rice production efficiency and maximizing its contribution to Nigeria's economic growth.

III. RESEARCH METHODOLOGY

The method, model specification and sources of data used in this research are chronologically identified and explained below:

3.1 Sources of data

The research used secondary data of rice production (RP), agricultural production (AGP) and nominal gross domestic product (GDP) which were collected from Food and Agricultural Organization (FAO) of United Nation the data range from 1980-2022.

For the purpose of this study, a unit root test was conducted to determine the integration order of the variables. The results showed that all variables were integrated of order one. Next, a co-integration test was performed to determine if a long-term relationship existed between the variables. the results showed the absence of co-integration. An unrestricted VAR was

carried out to determine the optimal lag order for the model, where Akaike recommended a maximum lag of three. Subsequently, the VAR was executed, followed by impulse response function and variance decomposition analysis for the purpose of forecasting

3.2 Model specification

The study adopted vector autoregressive (VAR) model, which can be specified as below:

$$\ln GDP_t = c_1 + \sum \beta_1 \ln GDP_{t-1} + \sum \phi_1 \ln AGP_{t-1} + \sum \Theta_1 \ln RP_{t-1} + \varepsilon_{1,t} \quad \ldots\ldots\ldots\ldots\ldots 1$$

$$\ln AGP_t = c_2 + \sum \beta_1 \ln GDP_{t-1} + \sum \phi_1 \ln AGP_{t-1} + \sum \Theta_1 \ln RP_{t-1} + \varepsilon_{2,t} \ldots\ldots\ldots\ldots\ldots.\ldots 2$$

$$\ln RP_t = c_3 + \sum \beta_1 \ln GDP_{t-1} + \sum \phi_1 \ln AGP_{t-1} + \sum \Theta_1 \ln RP_{t-1} + \varepsilon_{3,t} \quad \ldots\ldots\ldots\ldots\ldots.\ldots 3$$

C_1, C_2, and C_3 represents the intercepts in equation 1, 2 and 3 respectively.

β_1, ϕ_1 and Θ_1 represents the coefficient of the lnGDP lnAGP and lnRP respectively. ε_{1t} ε_2, and ε_3, are the error terms in equation 1, 2, and 3 respectively.

IV. RESULT DISCUSSION AND ANALYSIS

Table 1: Unit root test at first difference

Percentage	Lngdp prob. Value	Lnrp prob. Value	Lnagp prob. value
5% 10% 15%	0.0132	0.0000	0.0016

Source; Eviews 2010

From the table, it is evident that each variable is integrated of order one.

Table 2: con-integration test

Unrestricted Cointegration Rank Test (Trace)				
Hypothesized		Trace	0.05	
No. of CE(s)	Eigenvalue	Statistic	Critical Value	Prob.**
None	0.383346	28.11498	29.79707	0.0772
At most 1	0.136570	8.293635	15.49471	0.4345
At most 2	0.053932	2.273082	3.841466	0.1316
Trace test indicates no cointegration at the 0.05 level				

Source: Eviews 2010.

From the table, it is evident that there is a lack of cointegration between the variables.

Table 3: maximum lag length

Lag	LogL	LR	FPE	AIC	SC	HQ
0	-62.73316	NA	0.006384	3.459640	3.588923	3.505638
1	90.48451	274.1790	3.23e-06	-4.130764	-3.613631*	-3.946772*
2	101.3181	17.67587*	2.97e-06	-4.227269	-3.322287	-3.905283
3	112.4547	16.41175	2.72e-06*	-4.339719*	-3.046887	-3.879739
4	118.2131	7.576913	3.38e-06	-4.169111	-2.488430	-3.571138
5	125.8142	8.801315	3.95e-06	-4.095486	-2.026957	-3.359519

Source: Eviews 2010.

From the table, the maximum lag length is 3 as indicated by AIC.

Table 4: vector autoregressive (VAR) model

	LNGDP	LNRP	LNAGP
LNGDP(-1)	1.172678	-0.352625	0.415342
	(0.26272)	(0.46166)	(0.35342)
	[4.46366]	[-0.76383]	[1.17521]
LNGDP(-2)	-0.367044	0.153783	0.241684
	(0.35835)	(0.62970)	(0.48206)
	[-1.02427]	[0.24422]	[0.50135]
LNGDP(-3)	-0.100625	0.197872	-0.626776
	(0.21613)	(0.37979)	(0.29075)
	[-0.46558]	[0.52100]	[-2.15576]
LNRP(-1)	-0.124481	0.737636	-0.212183
	(0.10218)	(0.17955)	(0.13745)
	[-1.21829]	[4.10827]	[-1.54368]
LNRP(-2)	0.077172	0.466830	0.035176
	(0.11872)	(0.20862)	(0.15971)
	[0.65004]	[2.23773]	[0.22026]
LNRP(-3)	0.156936	-0.410062	0.300875
	(0.10175)	(0.17881)	(0.13688)
	[1.54230]	[-2.29332]	[2.19802]
LNAGP(-1)	0.072520	0.322258	0.942463
	(0.17374)	(0.30530)	(0.23372)
	[0.41740]	[1.05553]	[4.03238]
LNAGP(-2)	0.064777	-0.198047	-0.503768
	(0.21726)	(0.38178)	(0.29227)
	[0.29815]	[-0.51875]	[-1.72365]
LNAGP(-3)	0.110963	-0.079783	0.480413
	(0.15496)	(0.27231)	(0.20846)
	[0.71607]	[-0.29299]	[2.30457]
C	-0.394230	2.538692	-1.053921

	(0.69806)	(1.22666)	(0.93907)
	[-0.56475]	[2.06959]	[-1.12231]
R-squared	0.998865	0.940967	0.998042
Adj. R-squared	0.998525	0.923257	0.997454
Sum sq. resids	0.245772	0.758918	0.444769
S.E. equation	0.090512	0.159051	0.121761
F-statistic	2934.292	53.13234	1698.686
Log likelihood	45.08705	22.53727	33.22404
Akaike AIC	-1.754352	-0.626864	-1.161202
Schwarz SC	-1.332133	-0.204644	-0.738982
Mean dependent	15.98002	15.13255	14.51414
S.D. dependent	2.356638	0.574140	2.413115

Source: Eviews 2010

From the above table, it can be seen in the equations, the empirical results presented in the table reveal intriguing dynamics between GDP, rice production, and agricultural growth. Specifically, the findings indicate that a 1% increase in lagged GDP (lngdp(-1), lngdp(-2), and lngdp(-3)) has a positive, albeit diminishing, impact on current GDP, with corresponding increases of 1.172678%, -0.367044%, and -0.100625%, respectively. Conversely, the relationship between lagged GDP and rice production (lnrp) is more complex, with a 1% increase in lngdp(-1), lngdp(-2), and lngdp(-3) leading to a -0.352625% decrease, 0.153783% increase, and 0.197872% increase in lnrp, respectively. Furthermore, the analysis reveals that a 1% increase in lngdp(-1), lngdp(-2), and lngdp(-3) results in a 0.415342% increase, 0.241684% increase, and -0.626776% decrease in agricultural growth (lnagp), respectively.

It can also be seen in the equations, the empirical analysis reveals intriguing temporal dynamics in the relationships between rice productions (LNRP), GDP (LNRP), and agricultural growth (LNAGP). Notably, the findings indicate that a 1% increase in lagged rice production (lnrp(-1), lnrp(-2), and lnrp(-3)) has a positive impact on current rice production, with corresponding increases of 0.737636%, 0.466830%, and a decrease of -0.410062%, respectively. Furthermore, the results show that a 1% increase in lagged rice production leads to a mixed impact on GDP, with a -0.124481% decrease, 0.077172% increase, and 0.156936% increase, respectively.

Similarly, the analysis reveals that a 1% increase in lagged rice production results in a mixed impact on agricultural growth, with a -0.212183% decrease, 0.035176% increase, and 0.300875% increase, respectively.

Furthermore, from equations, the empirical analysis reveals the complex dynamics of agricultural growth (LNAGP) and its relationships with GDP (LNRP) and rice production (LNRP). Specifically, the findings indicate that a 1% increase in lagged agricultural growth (lnagp(-1), lnagp(-2), and lnagp(-3)) has a positive impact on current agricultural growth, with corresponding increases of 0.942463%, a decrease of -0.503768%, and an increase of 0.480413%, respectively. Moreover, the results show that a 1% increase in lagged agricultural growth leads to a positive impact on GDP, with increases of 0.072520%, 0.064777%, and 0.110963%, respectively. However, the analysis also reveals that a 1% increase in lagged agricultural growth has a mixed impact on rice production, with an increase of 0.322258%, a decrease of -0.198047%, and a decrease of -0.079783%, respectively. These findings highlight the intricate relationships between agricultural growth, GDP, and rice production, underscoring the need for policymakers to consider the lagged effects of agricultural growth on these critical sectors to inform evidence-based policy decisions that promote sustainable agricultural development and economic growth.

Figure 1: impulse response function
Response to Cholesky One S.D. (d.f. adjusted) Innovations ± 2 S.E.
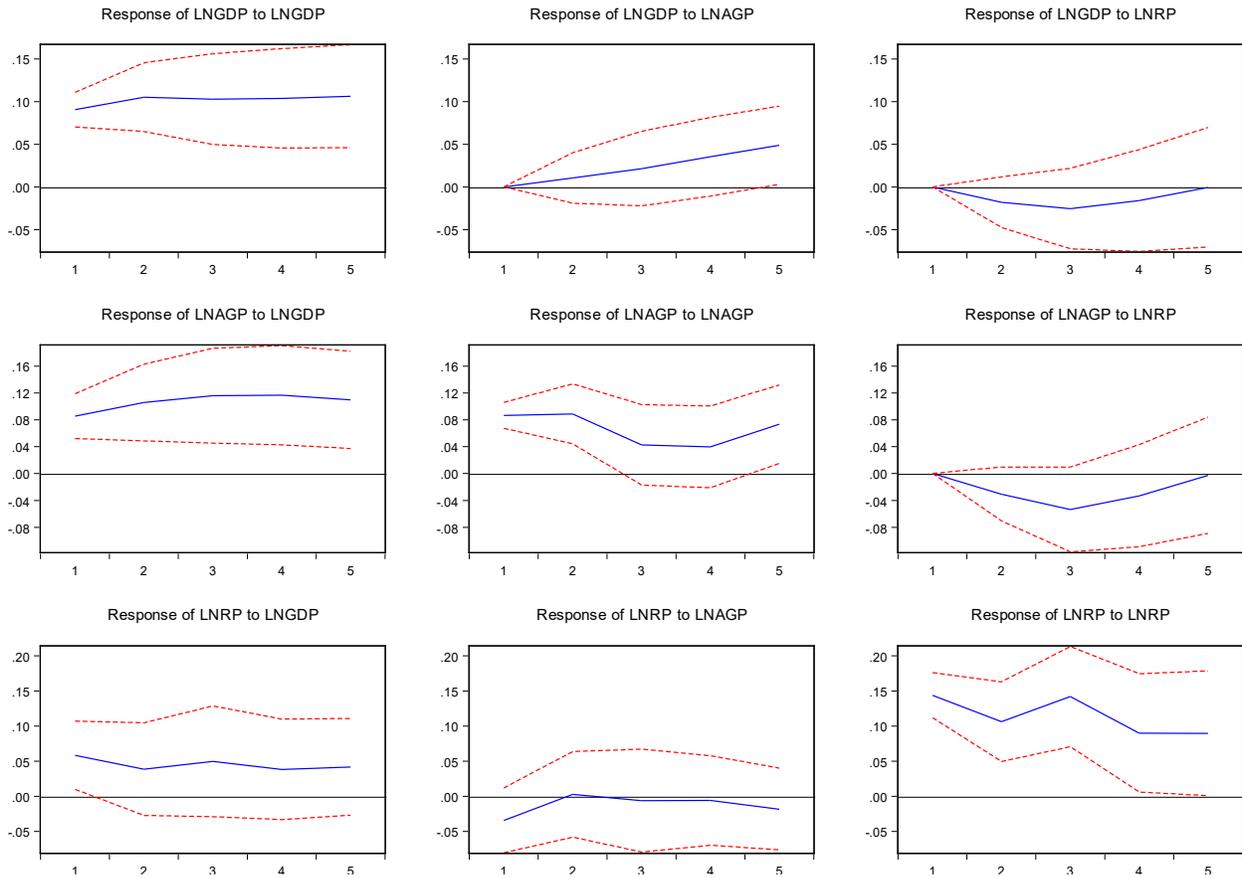
Source: Eviews 2010.

From the first row, the impulse response function analysis reveals the dynamic responses of GDP (lngdp) to shocks in itself, agricultural growth (lnagp), and rice production (lnrp). Notably, the results indicate that a one-standard-deviation shock to lngdp leads to a positive response that increases from year one to year two and remains stable thereafter, suggesting a persistent impact on GDP. In contrast, the response of lngdp to a shock in lnagp starts at zero and gradually increases over time, reaching its peak in year five, implying a delayed but ultimately positive effect on GDP. Meanwhile, the response of lngdp to a shock in lnrp exhibits a negative slope until year three, followed by a rebound to year five, although remaining within the negative territory, indicating a complex and dynamic relationship between rice production and GDP.

From the second row, the impulse response function analysis reveals the dynamic responses of agricultural growth (lnagp) to shocks in GDP (lngdp), itself, and rice production (lnrp). Specifically, the results show that a one-standard-deviation shock to lngdp leads to a gradual and continuous increase in lnagp from year one to year five, indicating a positive and persistent impact on agricultural growth. In contrast, the response of lnagp to a shock in itself exhibits a unique pattern, characterized by a rapid increase from year one to two, followed by a decline to year three, a stable period until year four, and a subsequent rise to year five. Furthermore, the response of lnagp to a shock in lnrp displays a similar pattern to the response of lngdp to lnrp, with a negative slope until year three and a rebound to year five, although remaining within the negative territory, suggesting a complex and dynamic relationship between rice production and agricultural growth.

From the third row, the impulse response function analysis reveals the dynamic responses of rice production (lnrp) to shocks in GDP (lngdp), agricultural growth (lnagp), and itself. Specifically,

the results show that a one-standard-deviation shock to lngdp leads to a decrease in lnrp from year one to two, followed by a slight increase to year three, a subsequent decrease to year four, and a stable movement to year five, indicating a complex and dynamic relationship between GDP and rice production. In contrast, the response of lnrp to a shock in lnagp exhibits a unique pattern, characterized by an initial negative response that gradually increases to the origin point, followed by a slight decline into the negative territory until the final period. Furthermore, the response of lnrp to a shock in itself displays a volatile pattern, marked by a decrease from year one to two, an increase to year three, a subsequent decrease to year four, and a stable movement to year five. These findings highlight the intricate relationships between rice production, GDP, and agricultural growth, underscoring the need for policymakers to consider these dynamic interactions when designing policies to promote sustainable agricultural development and economic growth.

Figure 2: variance decomposition

Variance Decomposition using Cholesky (d.f. adjusted) Factors
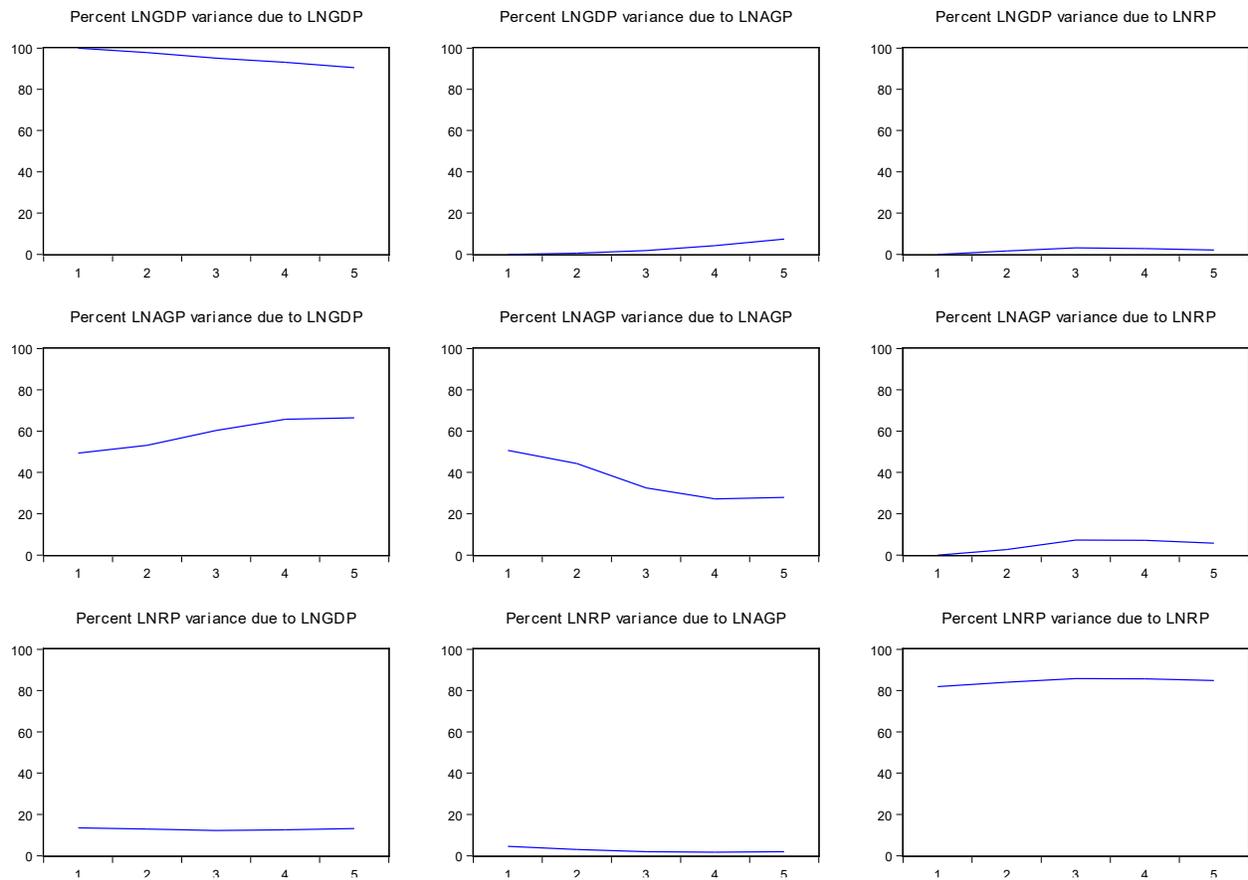
Source: Eviews 2010.

From the above table, the variance decomposition analysis reveals a fascinating dynamic in the explanatory power of each variable on the forecast error variance of lngdp. Initially, at year one, the entirety of lngdp's variability (100%) is attributed to its own shocks, while the contributions of lnagp and lnrp are negligible (0%). However, as the time horizon expands, the dominance of lngdp's own shocks gradually wanes, with its contribution decreasing concurrently with the increasing influence of lnagp and lnrp. This suggests that, over time, the impact of agricultural growth and rice production on GDP becomes more pronounced, while the role of GDP's own shocks diminishes. By the final period, the variability of lngdp is increasingly explained by the combined effects of lnagp and lnrp, highlighting the

interconnectedness of these macroeconomic variables and the need for policymakers to consider their dynamic interactions when formulating economic policies.

Subsequently, the variance decomposition analysis further reveals intriguing dynamics in the explanatory power of each variable on the forecast error variance of lnagp and lnrp. Initially, the variability of lnagp is attributed to lngdp by approximately 50%, which steadily increases over time, indicating a growing influence of GDP on agricultural growth. Conversely, the contribution of lnagp's own shocks to its variability declines continuously, while the impact of lnrp on lnagp emerges from obscurity and increases gradually. In contrast, the variability of lnrp is primarily driven by its own shocks, accounting for above 80% of the variation, with a steady and minimal contribution from lngdp and lnagp, below 20% and 10%, respectively. These findings suggest that agricultural growth is increasingly influenced by GDP, while rice production remains largely driven by its own dynamics, with a minor impact from GDP and agricultural growth. This nuanced understanding of the relationships between these variables is crucial for policymakers to design effective strategies promoting sustainable agricultural development and economic growth.

V. CONCLUSION

This research highlighted the impact and influence of the production of rice on Nigeria's economic growth. It has been demonstrated that increased in rice production will not only contributes to national food security but also an important contributing factor to economic growth. The findings of this research revealed an asymmetrical correlation between rice production, agricultural production and gross domestic product (GDP) at 95% level of significance. This implies that adaptive and innovative modern farming strategies will certainly improved rice yielding capacity thereby harnessing the full potential of rice production which in turn facilitates economic growth.

5.1 Recommendations
Generally, it is recommended that government and other stakeholders should prioritize investment in agricultural facilities and infrastructure such as irrigation systems, storage facilities and modern farm equipment to improve efficiency and productivity in rice. But specifically, the following recommendations are offered:

1. Policymakers should prioritize investments in agricultural growth, as it has a positive impact on GDP and rice production.
2. Economic policies should be designed to promote sustainable agricultural development, considering the dynamic interactions between GDP, agricultural growth, and rice production.
3. Rice production should be encouraged and supported, as it has a significant impact on agricultural growth and GDP.
4. The government should implement policies to reduce the volatility of rice production, such as irrigation schemes, crop insurance, and agricultural subsidies.
5. Further research should be conducted to explore the causal relationships between GDP, agricultural growth, and rice production, using more advanced econometric techniques.
6. The findings of this research can be used to inform the development of policies aimed at promoting economic growth, agricultural development, and food security in Nigeria.

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