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Rice Export and Its Effect on Gross Domestic Product in Nigeria: 2000 – 2023

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Abstract

This study examined the effect of rice export on Nigeria's Gross Domestic Product (GDP) using annual time series data covering the period 2000 to 2023. The study employed trend analysis, Ordinary Least Squares (OLS) regression, and the Autoregressive Distributed Lag (ARDL) model to analyze the relationship among rice export, exchange rate, and GDP. Unit root tests using the Augmented Dickey Fuller procedure revealed that all variables were stationary at level, implying that they are integrated of order zero I(0). The trend analysis indicated that exchange rate and rice export exhibited a positive trend over the study period, while GDP showed fluctuations across the years. The OLS regression results revealed that exchange rate had a positive but statistically insignificant effect on GDP ($p > 0.05$), while rice export also showed a positive but insignificant relationship with GDP. The ARDL estimation further showed that the lagged value of

GDP had a positive and statistically significant effect on current GDP ($p < 0.05$). Exchange rate demonstrated a positive relationship with GDP and was weakly significant at the 10 percent level ($p < 0.10$), whereas rice export remained statistically insignificant. The Granger causality test revealed a unidirectional causal relationship running from exchange rate to GDP. The findings concludes that although rice export has growth potential, its current contribution to Nigeria's GDP remains limited. The study therefore recommends policies aimed at improving rice productivity, export competitiveness and value chain development to enhance the role of agricultural exports in economic growth.

Keywords: Rice Export, Trends, Rice production, OLS model, ADL model, Nigeria

Introduction

The movement of products, services, and money across national borders between nations is referred to as international trade, often known as foreign trade. It deals with both imports and exports, whereby a nation purchases goods and services from another nation (imports) or sells goods and services to another nation (exports). The country that manufactures goods for export receives foreign exchange money from those sales, which fuels the country's economic growth (Stojanov et al., 2024). Nigeria's export industry is the backbone of the country's economy, generating foreign exchange profits, job creation, and economic progress. Nigeria's oil and non-oil export industries are included in this category. Examples of non-oil exports include labor, textiles, solid minerals, agricultural products, and so on. It consists of everything else we export from Nigeria, excluding petroleum goods (Aminu, 2018). Nigeria has always relied on oil export revenue to support its development objectives and economic expansion (Oyelaran-Oyeyinka, 2022).

Importance of agricultural products, particularly rice, to Nigeria's export industry is a reflection of both the country's potential economically and of its rich cultural legacy. Nigeria has made progress in utilizing its non-oil exports, such as agricultural products, to promote diversification, create new sources of income, raise GDP, and provide economic stability. Over the years, the Nigerian government has implemented several policies to boost domestic rice production, aiming to reduce import dependency and enhance self-sufficiency. Although Nigeria primarily focuses on meeting domestic demand, rice exports, albeit limited, have potential implications for its economy (Otsuka and Larson 2012). Rice is a significant crop in Nigeria, serving as a staple food for the majority of its population. Nigeria leads the African in rice production, contributing over 70% to the continental supply;

Nigeria does export rice to some African countries like Niger Republic, Chad, Benin Republic (USDA, 2023).

These differences suggest that Nigeria's agricultural export policies are insufficiently effective and that they could have far-reaching economic repercussions. Some of the issues this industry faces are post-harvest losses, insufficient value addition and processing facilities, inadequate infrastructure, currency volatility, hurdles to market access, poor productivity levels and policy gaps (Kaur et al. 2022).Currency fluctuations have a substantial impact on the profitability and competitiveness of Nigerian exports of rice due to a number of factors such as interest rates, recession, speculative activity, political unrest, current account deficits, terms of change, government debt, and inflation. (Segal, 2021) Exchange rate variations lead to pricing issues, affecting global customers' purchasing power and altering the cost dynamics for exporters. This affects regular financial growth, enterprise sustainability, and funding decisions. Uncertainty over export revenue is brought about by fluctuations in the Naira value relativeness to the most significant currencies in the world, such as the US dollar and EU Euro. Research has demonstrated that elevated fluctuations in exchange rates impede economic expansion by increasing domestic expenses, weakening productivity and profitability, and reducing competitiveness.

The broad objective of the study is to examine the trends of rice export, exchange rate and GDP, determine the impact of rice export on Nigeria's GDP, and examine the policy strategies for rice export competiveness.

Literature Review

Movable products produced inside a nation's borders and traded with another nation are referred to as exports. The nation that produces these items gains foreign exchange revenue from their sales, which further propels economic expansion in that nation (Focus Economics, 2023). Gross domestic product, or GDP, refers to the total monetary or market value of all finished goods and services produced inside a country's borders over a specific time period. It serves as a thorough assessment of the state of the economy in a particular nation by serving as a wide gauge of total domestic production (Chappelow, 2023). The relative cost of one currency represented in terms of another currency (or collection of currencies) is known as an exchange rate (Research Bank of Australia, 1983). It is crucial for figuring out the dynamics of trade and capital flow and is used to calculate the relative values of different currencies. The terms of trade refer to the rate at which the goods of one country exchange for the goods of another country (Jhingan, 2012). It is an indicator of the purchasing power of a country in terms of its exports

and imports, and is stated as the connection between export prices and import prices of products. Nigeria maintains the largest rice production in Africa, with production in 2024 estimated at roughly 5.23 million metric tons. However, insecurity in agricultural regions, high input costs, and unfavorable climatic conditions have led to concerns about declining yields. Despite these challenges, local rice production efforts are supported by investments in irrigation and mechanized farming (USDA, 2024).

Ricardo (1817), in his famed theory of comparative advantage, showed that countries benefit by specializing in the production of those goods with the lowest opportunity cost and trading the surplus of production over domestic demand, taking as given appropriate exchange-rate regimes. Under this model, a country will quickly specialize in sectors in which it has a comparative advantage. The classical theory is easily couched in terms of comparative cost specifically; the theory states that a country will tend to export the commodity whose comparative cost is higher in pre-trade isolation. Given the assumption of constant cost, a country will specialize completely in the production of commodity in which it has comparative advantage. Rice-producing countries have a comparative advantage over other countries because they can produce it at a much lower opportunity cost. The neoclassical (modern) theory of international trade arose in an attempt to improve some of the shortcomings of the classical theory. The neoclassical theory provided a more convincing explanation for the presence of comparative cost differences between countries by including capital as a second factor of production and accounting for international differences in demand patterns.

The Ohlin theory (1933) (also known as the H-O model) is a model in international economics that explains how countries engage in trade based on their relative factor endowments, essentially the amounts of labor, land, and capital they possess. The theory, developed by Swedish economists Eli Heckscher and Bertil Ohlin, proposes that countries will export items that intensely use factors of production that are abundant, while importing things that require factors that are relatively scarce. Sanjuán-López and Dawson (2010) use panel cointegration methods to investigate the relationship between GDP and agricultural and nonagricultural exports in 42 nations. Their findings suggest a long-run link between the variables in the model. The findings also demonstrate that agricultural exports from Granger stimulate economic growth. Confirm the export-led growth theory for the 42 nations under consideration. Similarly, Henneberry and Curry (2018) examine the relationship between agricultural exports and economic growth in Pakistan. Using three simultaneous equations representing GDP, agricultural exports, and imports, they find a favourable relationship between agricultural exports and economic growth in the country.

Empirical Review

Several studies have examined the relationship between agricultural exports and economic growth in developing economies. Sanjuán-López and Dawson (2010) investigated this linkage in a panel of 42 developing countries over the period 1970–2004, employing panel cointegration techniques. Their findings confirm a long-run equilibrium relationship between agricultural exports and GDP, with an estimated agricultural export elasticity of GDP at 0.07, while non-agricultural exports exhibit a higher elasticity of 0.13. The results support the export-led growth hypothesis, as total exports Granger-cause GDP, though structural differences emerge across income groups, suggesting balanced export promotion for lower-income countries and greater emphasis on non-agricultural exports for higher-income ones.

Similarly, Kang (2015) analyzed the role of agricultural exports, particularly rice, in major exporting countries including Thailand, Vietnam, India, and Pakistan, using data from 1980–2010. Employing an extended production function framework and time-series methods such as vector error correction models (VECM), the study demonstrates that rice exports exert a significant positive influence on economic growth in both the short and long run, underscoring their importance as a driver of GDP expansion in these economies.

In the Nigerian context, where heavy reliance on crude oil exports has rendered the economy vulnerable to external shocks, numerous studies advocate diversifying export earnings toward agricultural commodities to foster sustainable economic growth. Ijirshar (2015) conducted an empirical analysis using time-series data and econometric techniques, revealing a positive and significant long-run impact of agricultural exports on GDP growth. Olaleye et al. (2013) examined export diversification over a 30-year period, finding that increases in the shares of agricultural and non-oil exports positively affect per-capita GDP, with bidirectional causality between agricultural exports and growth confirmed via Granger causality tests.

Further supporting evidence includes Muhammad (2020), who utilized cointegration and vector error correction methods on 1980–2016 data to highlight agriculture's role in reducing oil dependence and enhancing non-oil exports and broader growth. Recent contributions, such as Utuk et al. (2023), affirm a positive association between agricultural exports and growth, amplified by value-added agriculture, while Owan (2020) notes positive effects from non-oil exports (including agriculture) on overall growth, albeit moderated by exchange-rate volatility.

Methodology

The study was conducted in Nigeria. Nigeria is a major country in West Africa, recognized for the size of its population and economic power. Nigeria is one of the continent's largest countries, with an area of around 923,769 square kilometers. It is a federal republic with 36 states and the Federal Capital Territory, which includes the capital city, Abuja. (Federal Republic of Nigeria,2024) Nigeria's topography is very diversified, with dry zones in the north, savannahs in the center, and tropical rainforests in the south (Geography of Nigeria, 2022). This diversified climate supports a wide range of agricultural operations. The country's diversified ecosystems enable the production of a wide variety of crops. Descriptive statistics were used to summarize and describe the key elements of the data on the value of rice exports, exchange rates, and GDP over the study period. OLS regression was employed to investigate the associations between a dependent variable and one or more independent variables (Beers, 2024).

The study employed a combination of trend analysis, Ordinary Least Squares (OLS) regression, and the Autoregressive Distributed Lag (ARDL) model to examine the relationship between rice export and economic growth in Nigeria. Trend analysis was first applied to evaluate the pattern of rice export, exchange rate, and GDP over the study period. This provides preliminary findings into the direction of movement of the variables.

Before estimating the regression models, unit root tests were conducted using the Augmented Dickey Fuller (ADF) procedure to determine the stationarity properties of the time series variables. Testing for stationarity is essential in time series analysis because non-stationary variables may lead to spurious regression results. The ADF test was therefore applied to examine whether the variables are stationary at the level or become stationary after differencing.

The Ordinary Least Squares (OLS) regression technique was then applied to estimate the short-run relationship between GDP and the explanatory variables. OLS was selected because it provides unbiased and efficient estimates when classical regression assumptions are satisfied.

To further capture dynamic relationships among the variables, the Autoregressive Distributed Lag (ARDL) model was employed. The ARDL approach is suitable for small sample sizes and allows for the inclusion of lagged values of both dependent and independent variables in the model. It also helps to examine both short-run and dynamic adjustments in the relationship between rice export, exchange rate, and economic growth. Diagnostic statistics, including the coefficient of determination, F statistic, and Durbin-Watson statistic, were used to evaluate the goodness of fit and reliability of the estimated models.

Trends Model:

To examine the trends in the value of rice export, exchange rate, and GDP, a simple trend analysis will be conducted. The model specification for this can be written as:

$_{Rt} = \alpha + b_t + \varepsilon_t$

Where:

$_{Rt}$ = the variables (rice export value, exchange rate, GDP)

t = time trend (2000-2023)

α = constant term

b = coefficient of the time trend

ε_t = error term

apriori expectation: b>0

Ordinary Least Square (OLS) regression Analysis:

To estimate the determinants of rice export in Nigeria, the following multiple regression model was used:

$RE_t = \beta_0 + \beta_1 EXR_t + \beta_2 GDP_t + \varepsilon_t$

Where:

RE_t = Rice export value

EXR_t = exchange rate

GDP_t = Gross Domestic Product rate

εt = stochastic error term

Apriori expectation: $\beta_1 > 0$; $\beta_2 > 0$

Autoregressive Distributed Lag (ARDL)

Impact of Rice Export on GDP: To assess the impact of rice export on Nigeria's GDP, this study employed the Autoregressive Distributed Lag (ARDL)

$GDPt = \alpha_0 + \alpha_{1R} E_{t-1} + \alpha_2 EXR_t + \alpha_3 GDP_t + \varepsilon_t$

Where:

RE_{t-1} = Lag of rice export

EXR_t = Exchange Rate

GDP_t = Gross Domestic Product of Nigeria

t= time (2000 to 2023)

εt = Stochastic error term

Apriori expectation: $\alpha_1 > 0$; $\alpha_2 > 0$; $\alpha_3 > 0$

Results and Discussion

Summary Statistics for all the variables

Table 1 presents the summary statistics for inflation (INF), exchange rate (EXR), GDP, and rice export (RICE) from 2000 to 2023. The result shows that the value of Skewness for exchange rate, and rice export are

greater than 1, and GDP is less than 1. The result also reveals that the values of Kurtosis for all the variables are greater than 1. The result reveals further that the values for Jarque-Bera for all the variables are greater than 1. Hence, ordinary least square and autoregressive distributed lag methods were employed.

Table 1: Summary Statistics for all the variables

	EXR	GDP	RICE
Mean	198.9996	5.050559	337.5417
Median	153.8625	5.612804	0.000000
Maximum	425.9792	15.32916	5196.000
Minimum	101.6973	-1.794253	0.000000
Std. Dev.	100.3166	3.630260	1158.649
Skewness	1.062442	0.430121	3.565803
Kurtosis	2.699514	4.287476	14.64698
Jarque-Bera	4.413531	2.397611	186.5120
Probability	0.110056	0.301554	0.000000
Sum	4576.991	121.2134	8101.000
Sum Sq. Dev.	221395.4	303.1120	30876760
Observations	23	24	24

Unit Root Test of the variables

Table 2 shows the unit root test result of the variables used in the study. The results show that all four variables exchange rate (EXR), GDP, and rice export (RE)—are stationary at level i(0)

Table 2: Unit Root Test of the variables

Variables	Level	First difference	Second difference	Order of Integration
EXR	-0.184638***	_____	_____	I(0)
GDP	-4.382761**	_____	_____	I(0)
RE	-4.910133***	_____	_____	I(0)

*** Significant at 1%, ** Significant at 5%, * Significant at 10% Probability Levels
Where EXR= Exchange Rate, GDP= Gross Domestic Product, RE= Rice Export

Trend Analysis of the variables

Table 3 shows the trend equation of Exchange rate. The result shows that the coefficient of time variable is positive and significant at 1 percent level of probability. This implies that it has positive trend. Figure 1 below shows the trend of growth in the Exchange Rate (EXR) from 2000 to 2023. From the graph, the exchange rate shows a sharp rise around 2016, likely due to the economic recession and reduced oil revenues, which pressured the naira. This period also saw the introduction of the Central Bank's flexible exchange rate policy in an attempt to stabilize the currency. Additionally, this continuous increase can be influenced by government policies like the

removal of fuel subsidies and exchange rate adjustments contributed to the Naira's depreciation during this period.

Table 3: Trend equation of Exchange Rate

Variable	Coefficient	t-Statistic	Probability
YEAR	13.16819	8.958935	0.0000
R-squared	0.792618		
Adjusted R-squared	0.782743		
F-statistic	80.26252		
Durbin-Watson stat	0.201957		

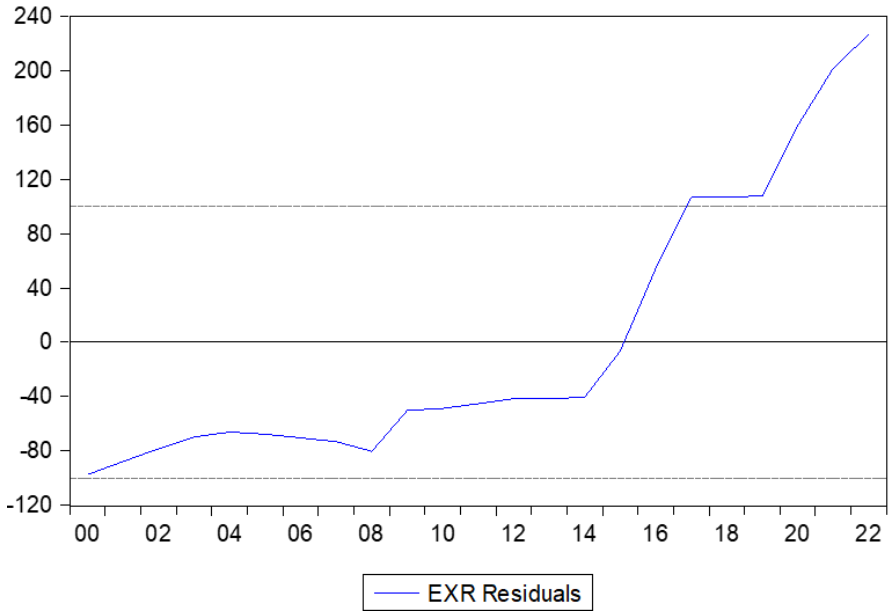

Figure 1: Graphical trend of Exchange rate: 2000 - 2023

Trend equation of Gross Domestic Product

Table 4 shows the trend equation of Gross Domestic Product. The result shows that the coefficient of time variable is negative and significant at 1 percent level of probability. This implies that it has negative trend. Figure 2 below shows the trend of growth in the Gross Domestic Product (GDP) from 2000 to 2023. The graph shows a general growth trend up to 2014, likely due to increased government spending and favorable oil prices. However, a sharp decline around 2016 reflects the recession and effects of reduced oil exports.

Table 4: Trend equation of Gross Domestic Product: 2000 - 2023

Variable	Coefficient	t-Statistic	Probability
YEAR	-0.357142	-4.541952	0.0002
R-squared	0.483923		
Adjusted R-squared	0.460465		
F-statistic	20.62933		
Durbin-Watson stat	1.709233		

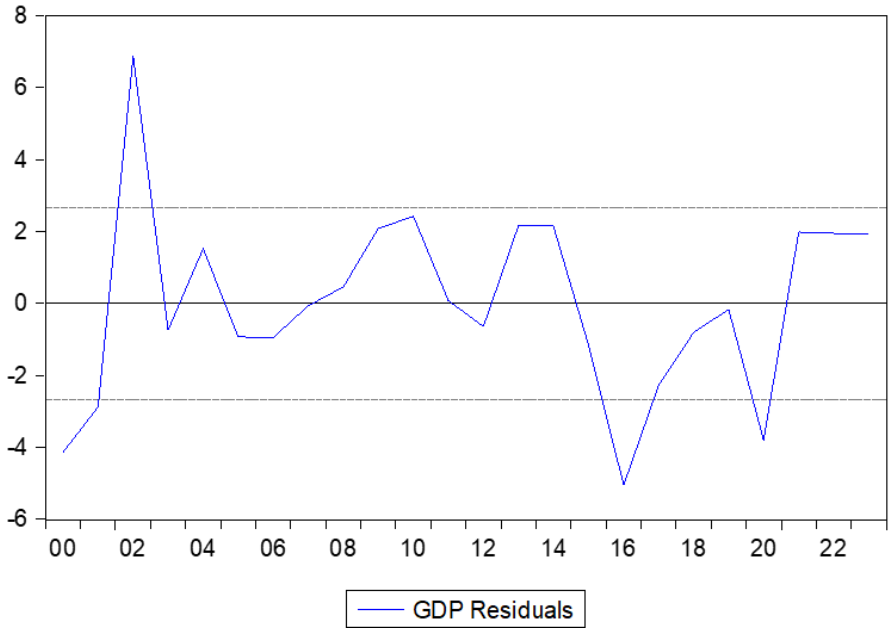

Figure 2: Graphical trend of Gross Domestic Product: 2000 - 2023

Trend equation of Rice Export

Table 5 shows the trend equation of Rice Export. The result shows that the coefficient of time variable is positive and significant at 1 percent level of probability. This implies that it has positive trend. Figure 3 below shows the trend of growth in Rice Export (RE) from 2000 to 2023. The graph shows that Nigeria's rice exports were minimal from 2000 to 2012 due to low production and reliance on imports. Exports increased between 2010 and 2014 with government efforts to boost local production, but faced a decline due to production challenges before rising again as self-sufficiency efforts improved.

Table 5: Trend equation of Rice Export

Variable	Coefficient	t-Statistic	Probability
YEAR	8.182174	0.234507	0.8168
R-squared	0.002493		
Adjusted R-squared	0.042848		
F-statistic	0.054993		
Durbin-Watson stat	2.182572		

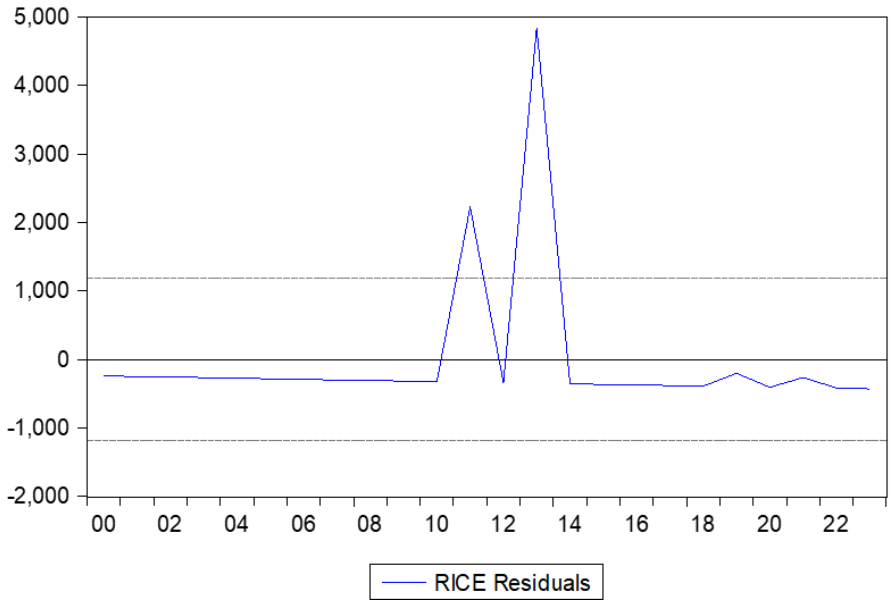

Figure 3: Graphical trend of Rice Export: 2000 - 2023

Estimated result of the relationship between (GDP) and the independent variables (EXR and RE)

Table 6 shows the estimated result of the dependent variable (GDP) with the independent variables (EXR and RE). The R-Square showing that the explanatory variable explained the variations in the dependent variable by 12 percent, while the error term explained 78 percent. The F-Statistics is 1.783899 and Durbin-Watson statistics is 0.914752.

The coefficient (0.218080) of EXR is positive and not significant in explaining GDP.

The result again shows that the coefficient (0.000546) of Rice Export is positive and not significant in explaining Rice Export. This implies that a unit increase in Rice Export led to about 0.01 unit increase in GDP. The result shows that no coefficient of any of the variables is significant, hence; none of the variables of (EXR and RE) has an impact on GDP

Table 6: The estimated result of the relationship between (GDP) and the independent variables (EXR and RE)

Variable	Coefficient	Std. Error	t-Statistic	Prob.
EXR	0.218080	0.118511	1.840169	0.0799
RE	0.000546	0.000650	0.840549	0.4101
C	2.347276	1.604667	1.462781	0.1583
R-squared	0.145223			
Adjusted R-squared	0.063815			
F-statistic	1.783899			
Durbin-Watson stat	0.914752			

***Significant at 1%, ** Significant at 5%, * Significant at 10% Probability Levels where RE = (Rice Export) EXR = (Exchange Rate) and GDP = (Gross Domestic Product)

Autoregressive Distributed Lag (ARDL) co-integration technique of the relationship between (GDP) and the independent variables (EXR and RE)

The R-Square is 0.421273 showing that the explanatory variable explained the variations in the dependent variable by 43 percent, while the error term explained 57 percent. The F-Statistics is 4.610234, and Durbin-Watson statistics is 1.963785.

Table 7 shows the estimated result of the dependent variable (GDP) with the independent variables (EXR and RE). The lagged value (GDP (-1)) has a positive coefficient of 0.514862 and significant at 5% level in explaining GDP. This implies that a unit increase in last period's GDP rate leads to a 0.5 unit increase in GDP. The coefficient of EXR (0.205423) is positive and significant at the 10% level. This implies that a unit increase in the exchange rate leads to a 0.2 unit increase in GDP. The result also shows that the coefficient of RE (0.000490) is positive but not significant in explaining GDP.

Table 7: Autoregressive Distributed Lag (ARDL) co-integration technique of the relationship between (GDP) and the independent variables (EXR and RE)

Variable	Coefficient	Std. Error	t-Statistic	Prob.*
GDP(-1)	0.514862	0.177830	2.895251	0.0093
EXR	0.205423	0.111468	1.842879	0.0810
RE	0.000490	0.00053	0.871361	0.3944
C	0.043415	1.603971	0.027067	0.9787
R-squared	0.421273			
Adjusted R-squared	0.329896			
F-statistic	4.610234			
Durbin-Watson stat	1.963785			

***Significant at 1%, ** Significant at 5%, * Significant at 10% Probability Levels where RE = (Rice Export) EXR = (Exchange Rate) and GDP = (Gross Domestic Product)

Pairwise Granger Causality Tests

The result from Table 8 indicates that from the time frame study, rice export is not competitive.

Table 8: Pairwise Granger Causality Tests

Sample: 2000 -2023			
Lags: 2			
Null Hypothesis:	Obs	F-Statistic	Prob.
GDP does not Granger Cause EXR	22	0.67628	0.5217
EXR does not Granger Cause GDP		3.25582	0.0635
RICE export does not Granger Cause EXR	22	1.66761	0.2181
EXR does not Granger Cause RICE export		0.45197	0.6438
RICE export does not Granger Cause GDP	22	0.17455	0.8413
GDP does not Granger Cause RICE export		0.02078	0.9795

Conclusion

The study examined the effect of rice export on Nigeria's Gross Domestic Product using annual data from 2000 to 2023. The empirical results indicate that rice export has a positive but statistically insignificant relationship with GDP in Nigeria. This suggests that although rice production and export activities are expanding, their direct contribution to national economic growth remains limited during the study period. On the other hand, exchange rate exhibited a weak positive relationship with GDP and showed marginal significance in the ARDL estimation, indicating that exchange rate movements may influence economic performance through trade channels. These findings imply that Nigeria has not yet fully harnessed the economic potential of rice exports as a driver of economic growth. Structural challenges such as low productivity, inadequate processing facilities, poor infrastructure, and limited access to international markets may have constrained the competitiveness of Nigerian rice in global markets. The study recommended that, the government should strengthen policies that promote rice production and export capacity in Nigeria. Although rice export showed a positive relationship with GDP, the effect was not statistically significant. This suggests that the current volume of rice exports is still too small to contribute meaningfully to economic growth. Expanding production through improved seed varieties, irrigation facilities, and mechanisation would help increase exportable surplus.

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Data Availability: All data are included in the content of the paper.

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