THE BLUE ECONOMY AND NIGERIA'S ECONOMIC GROWTH: EVIDENCE FROM THE AUTOREGRESSIVE DISTRIBUTIVE LAG MODEL

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Abstract
The study investigates the contribution of the blue economy to Nigeria's economic growth and assesses its viability as an investment frontier using annual time series data from 1981 to 2024. Employing the Autoregressive Distributed Lag (ARDL) bounds testing approach, the analysis examines both short-run and long-run dynamics between real GDP (proxy for economic growth) and key variables including the blue economy (proxied by the combined contribution of fisheries and water transport/storage to GDP), gross fixed capital formation, labour force, and trade openness. Pre-estimation diagnostics confirm mixed orders of integration, validating the ARDL framework, while the bounds test establishes the existence of a long-run cointegrating relationship. The results reveal that the blue economy exerts a positive but statistically insignificant effect on economic growth in the short run (current period). However, it lagged effects become positive and significant, and in the long run, a 1% increase in blue economy activities leads to approximately a 25.4% rise in real GDP. Gross fixed capital formation shows a negative and significant long-run impact, suggesting inefficiencies in investment allocation. Labour force and trade openness display mixed or insignificant effects. The study concludes that the blue economy represents a viable long-term driver of sustainable economic growth and diversification in Nigeria, despite delayed impacts. It recommends increased public and private investment in fisheries, aquaculture, and inland water transport, supported by infrastructure upgrades, skills development, and improved governance to unlock its full potential.

Keywords: Blue Economy, Economic Growth, ARDL Model, Nigeria

Introduction

The increasing volatility of global commodity markets, particularly crude oil, has intensified the search for alternative pathways to sustainable economic growth and development. In this context, the concept of the blue economy has emerged as a strategic framework for harnessing ocean and aquatic resources in a manner that promotes economic expansion, environmental sustainability, and social inclusion. The blue economy encompasses a broad spectrum of activities, including fisheries and aquaculture, maritime transport, offshore energy, coastal tourism, and other marine-based industries. For a country like Nigeria, endowed with an extensive coastline along the Gulf of Guinea and abundant inland water resources, the blue economy presents significant opportunities for economic diversification. Historically, Nigeria's economic growth has been largely driven by the oil sector, resulting in structural imbalances and vulnerability to external shocks. This overdependence on oil revenue has limited the development of other productive sectors, including marine-based economic activities.

Despite its considerable marine resource endowment, Nigeria has not fully optimized the potential of the blue economy. The fisheries subsector, for instance, remains dominated by small-scale artisanal practices, while the maritime transport system is characterized by inefficiencies and infrastructural deficits. Furthermore, issues such as marine pollution, illegal fishing, piracy, and weak institutional frameworks have constrained the sector's performance.

In recent years, there has been growing policy attention toward the development of the blue economy as a viable strategy for economic transformation. However, the extent to which blue economy activities have contributed to Nigeria's economic growth remains largely underexplored in empirical literature. More importantly, there is limited evidence on whether the sector possesses sufficient growth potential to justify increased investment by both public and private stakeholders.

It is against this backdrop that this study seeks to empirically examine the contribution of the blue economy to Nigeria's economic growth and to evaluate whether the sector represents a viable investment frontier. By employing the Autoregressive Distributed Lag (ARDL) approach, the study provides insights into both the short-run and long-run dynamics of the relationship, thereby offering a robust basis for policy and investment decisions.

Statement of the Problem

Nigeria's persistent reliance on the oil sector as the primary driver of economic growth has exposed the economy to significant external vulnerabilities, particularly in the face of fluctuating global oil prices. This has underscored the urgent need for diversification into alternative sectors capable of sustaining long-term growth and development. One such sector is the blue economy, which remains largely underdeveloped despite the country's abundant marine resources.

The underutilization of the blue economy in Nigeria is evident in the low productivity of fisheries, inefficiencies in maritime transport, and the limited development of other marine-based industries. Additionally, environmental challenges such as coastal degradation, pollution, and illegal, unreported, and unregulated fishing further constrain the sector's performance. These challenges have hindered the ability of the blue economy to make a substantial contribution to national output. Beyond these structural issues, a more critical concern lies in the lack of empirical evidence regarding the actual contribution of the blue economy to economic growth in Nigeria. While policy discussions increasingly emphasize the importance of marine resources, there is insufficient quantitative analysis to support claims about their growth-enhancing potential. This gap in the literature raises important questions about the effectiveness of current and proposed investments in the sector.

Furthermore, stakeholders including government agencies, private investors, and development partners require clear and evidence-based insights to guide investment decisions. Without empirical validation of the sector's impact on economic growth, it becomes difficult to ascertain whether increased investment in the blue economy would yield significant economic returns. Therefore, the central problem addressed by this study is the lack of empirical clarity on whether the blue economy has significantly contributed to Nigeria's economic growth and whether it constitutes a viable and worthwhile sector for investment. The broad objective of this study is to examine the contribution of the blue economy to economic growth in Nigeria and assess its investment viability. It specifically seeks to; examine the extent to which the blue economy has contributed significantly to economic growth in Nigeria as well as evaluate whether the blue economy possesses sufficient growth potential to justify increased investment by stakeholders in Nigeria.

The study is guided by the following research questions; to what extent has the blue economy contributed to economic growth in Nigeria and does the blue economy exhibit sufficient potential to warrant increased investment by stakeholders in Nigeria?

This study is significant from both academic and policy perspectives. Academically, it contributes to the limited empirical literature on the blue economy by providing evidence on its relationship with economic growth in Nigeria. The study also extends the application of the ARDL methodology to a relatively underexplored sector within the Nigerian economy. From a policy perspective, the findings of this study will provide valuable insights for government and regulatory authorities in designing strategies aimed at promoting economic diversification. By empirically assessing the contribution of the blue economy, the study offers a basis for evaluating its role as a potential driver of sustainable growth.

Furthermore, the study provides critical information for stakeholders, including private investors and development partners, regarding the viability of investing in blue economy sectors. By determining whether the sector significantly enhances economic growth, the study helps to inform resource allocation decisions and investment priorities. The rest of this paper is structured as follows: review of related literature is treated in section two; section three covers research methodology; empirical findings are covered in section four; while section five covers summary, conclusion, and recommendations.

Literature Review

Theoretical Literature

The theoretical foundation of this study is anchored on growth theories that explain the role of sectoral contributions, capital accumulation, and resource utilization in driving economic growth.

The Neoclassical Growth Theory, as developed by Solow (1956), provides a fundamental framework for understanding the relationship between factor inputs and economic growth. The theory posits that economic growth is driven by the accumulation of capital, labour, and exogenous technological progress. Within this framework, the blue economy proxied by fisheries and water transport/storage can be viewed as a component of capital and natural resource utilization that contributes to output. However, the Solow model also emphasizes diminishing returns to capital, which may explain the negative long-run effect of gross fixed capital formation observed in this study, especially in the presence of inefficiencies.

Closely related is the Endogenous Growth Theory, advanced by Romer (1986) and Lucas (1988), which emphasizes the role of human capital, innovation, and knowledge spillovers in sustaining long-term growth. Unlike the neoclassical model, endogenous growth theory posits that growth is internally determined within the economic system. In the context of this study, the development of the blue economy requires technological advancement, institutional support, and human capital development. The delayed impact of the blue economy observed in the empirical findings aligns with this theory, as the benefits of investment in such sectors depend on learning, innovation, and capacity building over time.

Furthermore, the Resource-Based Theory of Growth provides insight into how natural resources contribute to economic development. This theory posits that countries endowed with natural resources, such as marine and aquatic assets, can leverage them for growth if properly managed. The blue economy fits within this framework, as it involves the sustainable use of ocean and water resources for economic benefit. However, the theory also warns of the “resource curse,” where poor governance and mismanagement can hinder growth, which may explain the inefficiencies observed in capital formation within the Nigerian context.

The study is also underpinned by the Structural Change Theory, particularly the dual-sector model associated with Lewis (1954). This theory explains how labour moves from traditional, low-productivity sectors to modern, high-productivity sectors as the economy develops. The negative short-run impact of labour force observed in this study can be linked to surplus labour conditions, where increases in labour supply do not immediately translate into productivity gains due to limited absorptive capacity of the modern sector.

Conceptual Literature

The concept of the blue economy has gained prominence in recent years as a framework for promoting sustainable economic growth through the efficient use of ocean and aquatic resources. The term broadly refers to the economic activities associated with oceans, seas, rivers, and other water bodies, including fisheries, maritime transport, coastal tourism, and marine biotechnology. According to the World Bank (2017), the blue economy is defined as the sustainable use of ocean resources for economic growth, improved livelihoods, and jobs while preserving the health of marine ecosystems. Similarly, the United Nations Environment Programme (UNEP) conceptualizes the blue economy as an approach that balances economic development with environmental sustainability in marine and coastal areas.

In the context of this study, the blue economy is operationalized using measurable components fisheries and water transport/storage contributions to GDP. Fisheries represent the harvesting and processing of aquatic resources, which contribute to food security, employment, and export earnings. Water transport and storage, on the other hand, facilitate the movement of goods and services, thereby enhancing trade and economic integration.

Economic growth is conceptualized as the sustained increase in the real output of goods and services in an economy over time, commonly measured by real gross domestic product (GDP). Growth reflects improvements in productive capacity and overall economic performance.

Gross fixed capital formation (GFCF) refers to the net increase in physical assets such as infrastructure, machinery, and equipment within an economy. It is a key determinant of growth, as it enhances productive capacity. However, its effectiveness depends on the efficiency and productivity of the investments made.

Labour force represents the total number of individuals who are available and willing to work. It is a critical input in the production process, although its contribution to growth depends on factors such as skill level, education, and employment opportunities.

Trade openness is typically measured as the ratio of total exports and imports to GDP and reflects the degree of a country's integration into the global economy. It is expected to promote growth through increased market access, technology transfer, and efficiency gains, although its impact depends on the structure of trade.

Empirical Literature Review

Studies from Nigeria

A growing number of recent studies provide empirical support for the growth-enhancing potential of the blue economy in Nigeria. For instance, Mbaka, (2025) employed the Autoregressive Distributed Lag (ARDL) model using quarterly data from 2010 to 2023 to measure the effect of blue economy on Nigeria's economic growth and found that key blue economy indicators such as fisheries output, maritime transport,

shipping connectivity, and port through exert a positive and statistically significant long-run effect on real GDP. The study further revealed that while short-run effects vary across subsectors, fisheries and inland water transport demonstrate the strongest long-term contributions to economic growth.

Similarly, Agh, Ukommi, Ekpenyong and Effiong, (2020) and Esin, Evans, and Ndekhedehe (2025) analyzed the fisheries and aquaculture subsector using regression techniques and reported that aquaculture production contributes more significantly to Nigeria's GDP compared to capture fisheries. Their findings underscore the importance of technological advancement and investment in aquaculture as a driver of economic growth.
In a related study, Ukagwu et al. (2025**)** examined the contributions of fisheries and aquaculture and found that, despite their recognized potential, the sector's actual contribution to the Nigerian economy remains below expectations due to structural and institutional constraints. This suggests that while the blue economy has growth potential, its effectiveness depends on the level of investment and policy support.

Furthermore, Umehai et al, (2026) emphasized the role of the blue economy in enhancing GDP and improving the livelihoods of artisanal fisher folk, particularly within Nigeria's Exclusive Economic Zone (EEZ). The study highlighted that effective maritime spatial planning and resource management are critical for maximizing the economic benefits of marine resources. At the micro level, Esin (2024) investigated community-level investment in marine fisheries in the Niger Delta and found that increased investment significantly enhances productivity and income generation, thereby supporting broader economic development. The study concluded that the fisheries subsector holds substantial untapped investment potential.
In addition, Emenyonu et al, (2025**)** examined the role of maritime security in blue economy development using a structural equation model and found that insecurity, particularly piracy and oil theft, negatively affects the performance of marine-based sectors. This highlights the importance of institutional and security frameworks in unlocking the economic benefits of the blue economy.
Beyond Nigeria, empirical studies from other regions provide further insights into the blue economy-growth nexus.

Oyebanji, Ogunoye, and Ebenezer (2024**)** investigated the ocean economy in South Africa using ARDL and causality techniques. Their findings indicate a long-run equilibrium relationship between ocean-based activities (such as fisheries and renewable marine resources) and economic growth, confirming that the blue economy contributes significantly to GDP expansion. The study also established a causal link between marine resource utilization and economic growth, reinforcing the sector's strategic importance. In a broader African context, Popoola and Olajuyigbe (2023) examined the operationalization of the blue economy in the Gulf of Guinea and concluded that marine resources have substantial potential to drive economic growth and regional development. However, the study emphasized that governance challenges, environmental risks, and weak institutional capacity remain significant constraints.
Additionally, Elegbede et al. (2023/2025) explored the role of sustainability frameworks in seafood systems and found that effective management of marine ecosystems enhances economic resilience and long-term productivity. Their findings suggest that sustainability is a critical determinant of the blue economy's contribution to economic growth.

Synthesis of Empirical Literature
The empirical evidence reviewed reveals three key insights:

First, most studies, both within and outside Nigeria, establish a positive relationship between blue economy activities and economic growth, particularly in the long run. This supports the argument that marine-based sectors can serve as viable drivers of economic diversification. Secondly, the magnitude of this contribution varies across subsectors, with fisheries, aquaculture, and maritime transport emerging as the most significant contributors. However, inefficiencies in port infrastructure and weak maritime systems often limit the realization of short-run benefits. Thirdly, the literature consistently highlights that the investment potential of the blue economy is conditional on factors such as institutional quality, technological development, environmental sustainability, and maritime security. In the absence of these enabling conditions, the sector's contribution to economic growth may remain suboptimal.

Implication for the Present Study

While existing studies provide valuable insights, there remains limited empirical work that simultaneously evaluates; the statistical significance of the blue economy's contribution to economic growth, and its implication for investment decision-making in Nigeria. This study addresses this gap by adopting the ARDL framework to provide a comprehensive analysis of both the growth impact and the investment viability of the blue economy in Nigeria.

Methodology

This section captures the model to be estimated and the analytical techniques, as well as presenting the nature and sources of data used in the study.

Model Specification

To achieve the objectives of the study, the functional relationship between the blue economy and economic growth is specified as:

$$GDP_t = f(BE_t, INV_t, LAB_t, TRADE_t) \quad (1)$$

This is expressed in econometric form as:

$$GDP_t = \beta_0 + \beta_1 BE_t + \beta_2 INV_t + \beta_3 LAB_t + \beta_4 TRADE_t + \epsilon_t \quad (2)$$

Where:

GDP_t= Real Gross Domestic Product (proxy for economic growth)

BE_t= Blue economy indicator

INV_t= Investment (Gross Capital Formation)

LAB_t= Labour force

$TRADE_t$= Trade openness

ϵ_t= Error term

To improve estimation efficiency and interpretability, the model is transformed into a log-linear form:

$$\ln GDP_t = \beta_0 + \beta_1 \ln BE_t + \beta_2 \ln INV_t + \beta_3 \ln LAB_t + \beta_4 \ln TRADE_t + \epsilon_t \quad (3)$$

Sources of Data

The data used for this study was purely obtained from secondary sources. These sources were the Central Bank of Nigeria statistical bulletin, National Bureau of Statistics. Data on labour force participation rate were obtained from the National Bureau of Statistics while data on all other variables were obtained from the Central Bank of Nigeria statistical bulletin. The data, which are time series in nature, covers the period of 1981 to 2024 which gives a total of forty-two (44) observations

Measurement of Variables

Given the absence of a comprehensive measure of the blue economy, appropriate proxies are employed.

Economic Growth (GDP): Measured by Real GDP at constant basic prices.
Blue Economy (BE): Proxied using indicators such as fisheries output, maritime transport activities, or port throughput (depending on data availability).
Investment (INV): Measured by Gross Fixed Capital Formation.
Labour (LAB): Total labour force or employment level.
Trade Openness (TRADE): Ratio of total trade (exports + imports) to GDP.

All variables are expressed in natural logarithms to stabilize variance and interpret coefficients as elasticities.

Technique of Analysis

The autoregressive distributed lag (ARDL) model and the threshold regression analysis were employed to analyze the data.

Pre-Estimation Diagnostic Test

The unit root test was carried out to ascertain the order of integration of the time series variables. As stated earlier, the variables must be in mixed order of levels and first difference before the ARDL approach could be considered appropriate. In this study, we utilize the Augmented Dickey-Fuller (ADF) unit root test developed by Dickey & Fuller (1979) based on the constant and trend assumption. In its general form, the model for the test is specified thus.

$$\Delta y_t = \varphi + \delta t + \beta_1 y_{t-1} + \sum_{i=1}^{p} \rho_i \Delta y_{t-i} + \varepsilon_t \qquad (4)$$

The variable to be tested for unit root is y, p represents the lag length, which is to be automatically selected, t captures the trend, φ represents the drift or constant terms, the summation part of the model represents the augmented component of the test to account for serial correlation, Δ is the difference operator, and ε is the error term. The test is conducted by testing the null hypothesis that $\beta_1 = 1$ as against the alternative that $\beta_1 < 1$. The rejection of the null hypothesis implies that there is no unit root. This is only obtainable when the ADF statistic is more negative than the 5% critical value of the test.

The use of the ARDL bounds test for cointegration is derived from the integration of some of the variables at levels and others by first difference. This method of cointegration analysis developed by Pesaran, Shin and Smith (2001) is appropriate in this scenario compared to the usual Engel-Granger cointegration test which is valid when all the variables are stationary at first difference. The general form of the test s specified thus;

$$\Delta RGDP_t = \tau'_0 + \pi_i^{'} X_i^{'} + \sum_{i=1}^{n} \gamma_i' \Delta RGDP'_{t-i} + \sum_{i=0}^{m} \vartheta'_i \Delta X'_{t-i} + \epsilon_t \qquad (5)$$

Where: *X* represents all the explanatory variables in the model, *n* is the optimal lag length of the dependent variables while *m* captures that of the explanatory variables. The parameter $\pi_i^{'}$ denotes the long-run estimates of the model's parameters while γ_i' and ϑ'_i represents the short-run parameters.

The estimation of the above equation generates an F-statistic which is used for the test. The F- statistics test grounded on the Wald test techniques is applied to ascertain the acceptance or otherwise, the rebuff of the null hypothesis. This is obtainable by matching the theoretical F-statistics value with the Pesaran, Shin, & Smith(2001) bound critical values. If the estimated F-statistics value is more than the upper bound critical value, the null hypothesis is rejected, and cointegration among the variables exists. However, if the estimated F-statistics value is less than the lower bound critical value, the null hypothesis is upheld, and there is no cointegration among the variables. Meanwhile, the result is inconclusive if the estimated F-statistics value lies between the upper and lower bound critical values. The usual cointegration approach must be employed in this scenario to establish the order of integration of the variables. In general, the test is conducted at the 5% level of significance across all the three models.

Autoregressive Distributed Lag (ARDL) Model

To examine the influence of public debt on economic growth of Nigeria, the autoregressive distributed lag (ARDL) model was utilized. The ARDL model is a model which contains the lagged values of the dependent variable and the current and lagged values of the regressors. The ARDL model enables us to estimate reliable estimates of our parameters in the situation where the unit root test reported that the series were stationary in mixed order of level and first difference. The model is specified as follows:

$$RGDP_t = \theta + \sum_{i=1}^{p} \gamma_i RGDP_{t-i} + \sum_{i=0}^{q_1} \beta_i GFCF_{t-i} + \sum_{i=0}^{q_2} \alpha_i DEBT_{t-i} + \sum_{i=0}^{q_3} \delta_i DEBT_{t-i}^2 + \sum_{i=0}^{q_4} \pi_i INF_{t-i} + \sum_{i=0}^{q_5} \vartheta_i EXC_{t-i} + \sum_{i=0}^{q_6} \sigma_i INT_{t-i} + \sum_{i=0}^{q_7} \rho_i NSE_{t-i} + \sum_{i=0}^{q_8} \omega_i LAB_{t-i} + \varepsilon_t \qquad (6)$$

Where the variables are as earlier defined, p is the optimal lag length for the regressand while q is the optimal lag length for the regressors. In the event where cointegration exist (based on the Bounds test), the error correction model is estimated to showcase how disequilibrium in the model is corrected in order to restore equilibrium in the long run. The error correction model is therefore specified as follows:

$$\Delta RGDP'_t = \tau'_0 + \sum_{i=1}^{n} \gamma_i' \Delta RGDP'_{t-i} + \sum_{i=0}^{m} \vartheta'_i \Delta X'_{t-i} + \zeta ECM_{t-1} + \epsilon_t \qquad (7)$$

The only difference between Equation (8) and Equation (9) is the introduction of the ECM term in the later plus the exclusion of the long-run component of the model. The ECM term, ζ, measures how fast any distortions in the short-run will likely be corrected in the model to attain long-run equilibrium. This forms the basis for the estimation of the dynamic short-run estimates and the levels or long-run estimates of the models.

Descriptive Statistics

The descriptive properties of the time series variables employed in the study is presented in Table

Table 1: Descriptive properties of the time series variables

	RGDP	GFCF	LABF	TRN	BLUEC
Mean	10.45409	27.56045	53.09568	33.43591	5.086136
Median	10.36500	25.57000	52.69500	33.03500	5.070000
Maximum	11.28000	79.95000	68.20000	53.28000	5.970000
Minimum	9.680000	13.79000	51.28000	16.35000	3.770000
Std. Dev.	0.559515	14.93374	2.649409	9.466592	0.675991
Skewness	0.151095	1.656515	4.564786	0.247164	-0.141820
Kurtosis	1.415196	6.122419	25.76663	2.335461	1.778292
Jarque-Bera	4.772028	37.99706	1103.059	1.257615	2.883874
Probability	0.091996	0.000000	0.000000	0.533227	0.236469
Observations	44	44	44	44	44

Source: *Researcher Computation*

Over the forty-four (44) years under consideration, the log of real GDP averaged 10.454%, possessed a standard deviation of 0.559 and is positively skewed and platykurtic in nature. The gross fixed capital formation averaged 27.560% with a standard deviation of 14.933 and the variable is positively skewed and leptokurtic in nature. Labour force averaged 53.095% while the minimum reported over the years is 51.280%.trade openness average 33.435% with a standard deviation of 9.466%, blue economy is seen to average 5.086%, the lowest to other variables used in the study same with its standard deviation of 0.675%. The descriptive properties of other variables could be defined in similar patterns as contained in Table 2.

Correlation Analysis

In order to check the direction and magnitude of the association among the variables in the model, the correlation analysis was conducted, and the Pearson correlation coefficients are presented in Table 2.

Table 2: Correlation coefficient

	RGDP	GFCF	LABF	TRN	BLUEC
RGDP	1.000				
GFCF	-0.794	1.000			
LABF	0.487	-0.333	1.000		
TRN	-0.654	0.436	-0.224	1.000	
BLUEC	0.965	-0.695	0.469	-0.644	1.000

Source: *Researcher Computation*

The result of the correlation analysis presented in Table 3 shows that real GDP correlated negatively with both gross fixed capital formation and trade openness, meanwhile, real GDP is strongly and positively correlated with the blue economy but that of labour force, although positive but it has a weak association. For the regressors, no perfect correlation exists among them which therefore rule out the possibility of multi-collinearity in the model.

Unit Root Test

The stationarity property of the time series variables was explored using the Philips-perron unit root test. The test was conducted using the constant and trend assumption and Table 3 presents the result. An I(0)

series implies that the variables are stationary at level while an I(1) series implies that the series is stationary at first difference.

Table 3: Unit root test result

	ADJ Statistic at Level		ADJ Statistic at First Difference		
Variables	ADJ Statistic	p-value	ADJ Statistic	p-value	Order of Integration
RGDP	-2.9578	0.1556	-3.5207	0.0249*	I(1)
GFCF	-3.5180	0.0009*	-------	---------	I(0)
LABF	-3.5180	0.0061*	-------	---------	I(0)
TRN	-3.5180	0.0340*	-------	---------	I(0)
BLUEC	-3.5180	0.1269	-3.5207	0.0034*	I(1)

Note: ** and ** implies significance at 5% and 1% respectively*
Source: Researcher Computation

Co-integration Test

With the unit root test reporting that some of the variables were stationary at first difference while inflation rate was stationary at level, the Bounds test for co-integration was employed to examine the existence of long run relationship in the model. Table 4 presents the result. It is expected that the F-statistic must lie outside the 5% lower and upper bounds for co-integration to exist.

Table 4: Bounds test for co-integration result

F-Bounds Test		Null Hypothesis: No levels relationship		
Test Statistic	Value	Significance	I(0)	I(1)
F-statistic	7.069117	10%	2.21	3.09
K	4	5%	2.56	3.49
		2.5%	2.88	3.87
		1%	3.29	4.37

Source: ***Researcher Computation***

The co-integration result in Table 5 indicates that the F-statistic is 7.069117 and the 5% critical I(0) and I(1) values are 2.56 and 3.49 respectively. Since the F-statistic lies outside these lower and upper bounds, co-integration exists. Thus, we estimated both the short run and long run estimates for the model using the autoregressive distributed lag (ARDL) model.

The Short Run Model

The error correction model was estimated to showcase how the short run distortions in the model is corrected. The result in Table 6 indicates that 36.38% of the short run distortions in the model is corrected annually to restore long run equilibrium. Also, the model explains about 81.25% of the total variations in economic growth during the study period.

Table 5: Short run error correction model result

Dependent Variable: D(GDP)

Selected Model: ARDL(2, 2, 2, 2, 1, 2, 2, 1, 1)

Variable	Coefficient	Std. Error	t-Statistic	Prob.
D(RGDP(-1))	-0.453554	0.127781	-3.549479	0.0016
D(RGDP(-2))	-0.296528	0.127891	-2.318593	0.0293
D(GFCF)	-0.006122	0.000908	-6.740515	0.0000
D(GFCF(-1))	0.002597	0.001362	1.907468	0.0685
D(LABF)	0.001919	0.001545	1.241999	0.2262
D(LABF(-1))	-0.035728	0.005484	-6.515457	0.0000
D(LABF(-2))	-0.154607	0.031368	-4.928747	0.0000
D(TRN)	-0.000725	0.000436	-1.663471	0.1092
D(BLUEC)	0.006012	0.026254	0.228987	0.8208
D(BLUEC(-1))	0.030896	0.023790	1.298655	0.2064
D(BLUEC(-2))	0.071972	0.021252	3.386558	0.0024
CointEq(-1)*	-0.363852	0.050824	-7.158987	0.0000

R-squared	0.812593	Mean dependent var	0.038780
Adjusted R-squared	0.741507	S.D. dependent var	0.036000
S.E. of regression	0.018303	Akaike info criterion	-4.924412
Sum squared resid	0.009715	Schwarz criterion	-4.422878
Log likelihood	112.9504	Hannan-Quinn criter.	-4.741781
Durbin-Watson stat	2.123381		

*Note: * and ** implies significance at 5% and 1% respectively*

Source: Researcher Computation

The coefficient of RGDP(-1) portrays that the previous period's RGDP reduces the current period's RGDP and is statistically significant. Gross fixed capital formation and its one-period lag both had significant effect on economic growth, but a negative relationship was observed between the one period lag and economic growth. Thus, a 1% increase in capital leads to a 0.0025% increase in economic growth while the previous period's stock of capital decreases the current period's RGDP by 0.0061% on average. it is further observed that labour force (LABF) exhibits a positive but statistically insignificant relationship with economic growth, as indicated by its coefficient**.** This implies that, within the current period, increasing labour supply does not immediately lead to increase in economic growth. However, the negative and statistical significance of the lag values means that increases in labour force in previous periods reduce economic growth in the short run.

Nigeria's engagement in trade during the study period exerted a negative and insignificant effect on economic growth in the short run. This therefore implies that trade does not contribute to economic growth in the short run.

It is observed that the blue economy (BLUEC), proxied in this study as the combined contribution of fisheries and water transport/storage to GDP, exhibits a positive but statistically insignificant relationship with economic growth in the current period, This indicates that, in the short run, changes in blue economy activities do not exert an immediate and meaningful impact on economic growth.

Similarly, the first period lag was positive but statistically insignificant; suggesting that even in the immediate past period, the effect of the blue economy on growth is still weak and not strong enough to

influence economic growth. However, the second lag period was positive and statistically significant, indicating that the blue economy exerts a strong and positive influence on economic growth after two periods. This clearly demonstrates that the impact of the blue economy is not instantaneous but materializes over time.

The Long Run Model

Table 6: Long run estimates

Variable	Coefficient	Std. Error	t-Statistic	Prob.
GFCF	-0.037638	0.006650	-5.660180	0.0000**
LABF	0.085661	0.045739	1.872836	0.0733*
TRN	0.000393	0.002327	0.168868	0.8673
BLUEC	0.254160	0.105342	2.412706	0.0238**
C	5.795662	1.883774	3.076623	0.0052

*Note: * and ** implies significance at 10% and 5% respectively*

Source: ***Researcher Computation***

The coefficient of gross fixed capital formation is negative and statistically significant, This implies that, in the long run, an increase in capital formation leads to a reduction in economic growth. Specifically, a 1% increase in GFCF is associated with about a 3.76% decrease in GDP, holding other factors constant. The coefficient of labour force was also observed to be positive and statistically significant, suggesting that labour force contributes positively to economic growth in the long run, although the effect is relatively weak. However, the weak significance indicates that labour alone is not a strong driver of growth unless supported by other factors such as skills, technology, and capital. The coefficient of trade openness is positive but statistically insignificant indicating that trade openness has no meaningful impact on economic growth in the long run. Although the relationship is positive, which indicate that a 1% increase in trade openness leads to almost no increase in economic growth in the long run within the study period? This result is similar to that of the short run.

The coefficient of blue economy is positive and statistically significant indicating that the blue economy which is measured as the combined contribution of fisheries and water transport/storage to GDPhas a strong and positive impact on economic growth in the long run. Specifically, a 1% increase in blue economy leads to approximately a 25.4% increase in GDP, holding other factors constant.

Post Estimation Diagnostic Test

The various post diagnostic tests conducted include stability test, normality test, serial correlation test, and heteroscedasticity test.

Stability Test

The stability test was conducted to ascertain whether the parameter estimates of the ARDL model are stable for policy simulation. The test presented is based on the cumulative sum (CUSUM) of squares test. The test demands that for stability to exists, the CUSUM line must lie within the 5% critical lower and upper bounds.

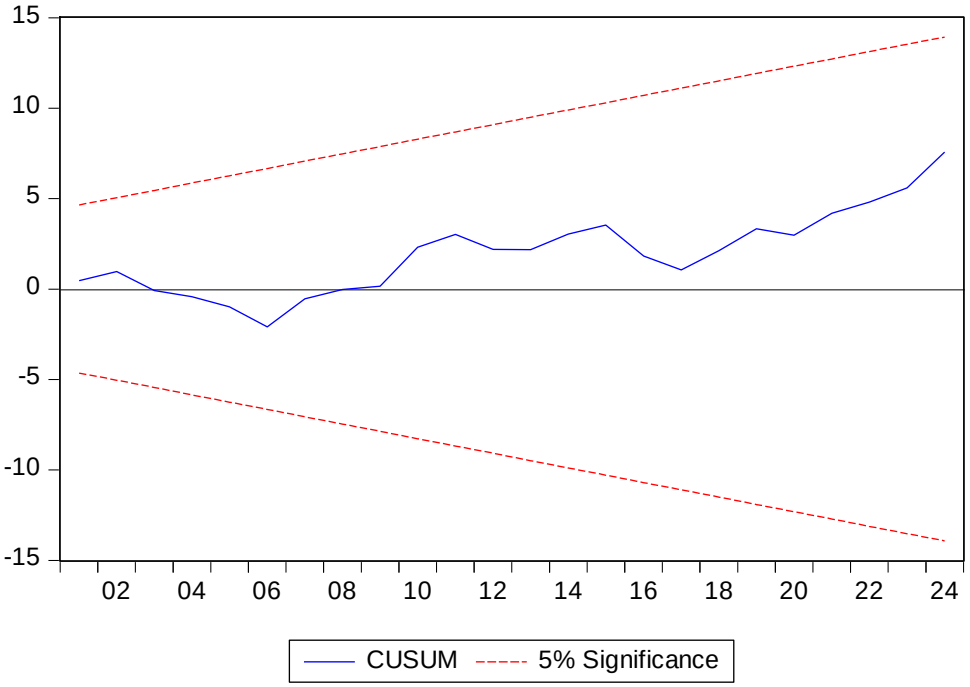

Figure 1: The cumulative sum of squares test for stability

It is observed from Figure 1 that the CUSUM of squares line lies within the 5% critical lower and upper bounds. Consequently, the stability of the parameter estimates is guaranteed in the estimated model.

Normality Test

The normality test was done using the histogram normality test for residuals. Figure 3 presents the result from which inferences are made using the Jarque-Bera statistic.

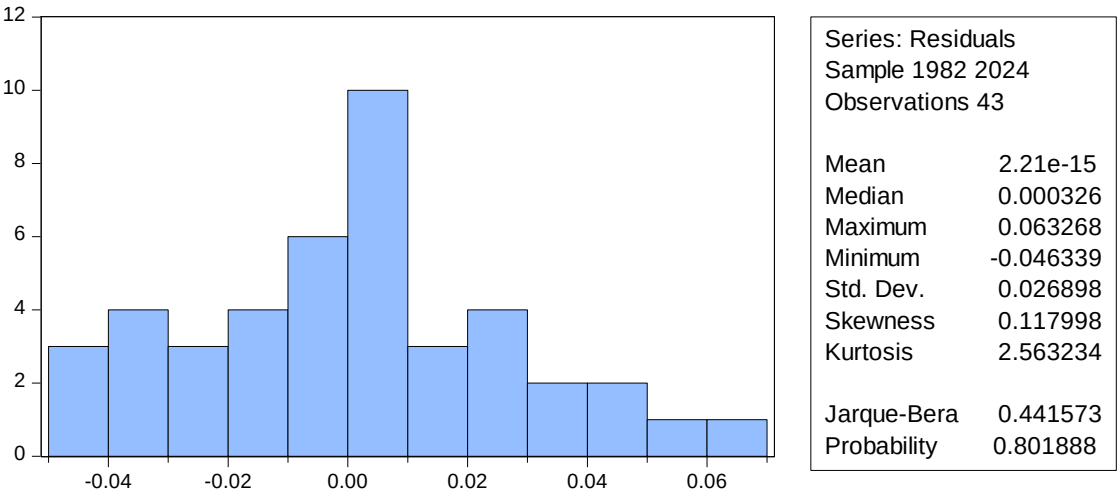

Figure 2: Normality test for residuals

The Jarque-Bera statistic of 0.441573 with the accompanying p-value of 0.801888 is a clear indication that normality assumption is satisfied in the estimated model.

Serial Correlation Test

The serial correlation test is presented in Table 10 and is conducted using the Breusch-Godfrey serial correlation LM test.

Table 7: Breusch-Godfrey Serial Correlation LM Test Result

F-statistic	0.798258	Prob. F(2,22)	0.14627
Obs*R-squared	2.774017	Prob. Chi-Square(2)	0.2498

Source: Researcher's Computation.

Given that the F-statistic of 0.798258 is statistically insignificant at the 5% level, it is a clear indication that the null hypothesis of no serial correlation is accepted.

Heteroscedasticity Test

The test for the constant variance assumption of the error terms (heteroscedasticity test) was conducted using the Breusch-Pagan-Godfrey test. Table 11 presents the result obtained.

Table 8: Heteroskedasticity Test Result: Breusch-Pagan-Godfrey

F-statistic	0.4296	Prob. F(23,16)	0.9577
Obs*R-squared	9.1295	Prob. Chi-Square(16)	0.9080
Scaled explained SS	2.3195	Prob. Chi-Square(16)	1.0000

Source: Researcher's Computation.

The result in Table 8 shows that the F-statistic of 0.4296 is statistically insignificant at the 5% level. It therefore becomes pertinent to reject the null hypothesis and conclude that the error terms are homoscedastic.

Discussion of Major Findings

The major findings of this study are as follows**;**

i. The blue economy was observed to exert positive but insignificant relationship with economic growth in the current period, but it lags values exerted a positive and statistically significant in the short run. Similarly, it's exerted a positive and statistically significant effect on economic growth in the long run. This implies that the blue economy proxied by fisheries and water transport/storage serves as a viable driver of economic growth, although its benefits are not immediate but realized over time. This finding is in line with the study of Mbaka (2025**)**, who found that blue economy components such as fisheries and maritime transport exert weak short-run effects but become significant in the long run in Nigeria. Similarly, the studies of Oyebanji, Ogunoye, and Ebenezer (2024), in the context of South Africa, established a long-run positive relationship between ocean-based economic activities and GDP growth, reinforcing the argument that the blue economy serves as a long-term driver of economic expansion. However, the observed short-run insignificance disagrees with studies of Esin *et al,* (2025), which reported more immediate contributions from aquaculture, suggesting that the speed of impact may vary across subsectors and levels of technological development.

ii. Gross Fixed Capital Formation (Investment)also exhibits mixed effects i.e negative relationship in the current period and positive relationships with it slag with economic growth in the short run, This finding deviates from the predictions of neoclassical and endogenous growth theories, which posit that investment enhances productive capacity and fosters growth. However, it exerted a negative and statistically significant effect on economic growth in the long run. This suggests that investment in Nigeria may be possibly arising from inefficient or misallocated of resources, poor project implementation, or concentration of capital in non-productive sectors, thereby failing to translate into productive economic outcomes. This result aligns with the findings of Iyoha (1999**)** which argue that public investment in developing economies does not always translate into growth due to governance challenges and inefficiencies. However, it contrasts with studies such as Bakare (2011**)**, which reported a positive and significant relationship between capital formation and economic growth in Nigeria.

iii. The result revealed that labour force had a positive and insignificant relationship with economic growth in the short run, while its lagged values exert a negative and significant relationship with economic growth. This suggests that increases in labour supply may initially exert pressure on the economy, possibly due to unemployment and underemployment. Conversely, the short-run negative lag effects contrast with studies that assume immediate productivity gains from labour expansion, thereby underscoring the importance of skill acquisition and labour market efficiency.
However, the result in the long run revealed that labour force has a positive but weakly significant effect on economic growth. This therefore implies that labour contributes to growth over time, but in the short run, increases in labour supply may strain the economy due to unemployment, low skills, or poor labour absorption capacity. This result agrees with the findings of Todaro and Smith's dual-sector model, which posits that surplus labour in developing economies may initially have low or negative marginal productivity. Empirically, it aligns with Fashina et al. (2018), who found that labour contributes positively to growth in Nigeria only when complemented by improvements in human capital.

iv. Trade openness is found to have a positive but statistically insignificant effect on economic growth in both the short run and long run. This suggests that Nigeria's external trade has not significantly contributed to economic growth during the study period, possibly due to the structure of trade (e.g., reliance on primary exports).This suggests that Nigeria has not been able to effectively harness the benefits of international trade to stimulate economic growth. A plausible explanation lies in the structure of Nigeria's trade, which is heavily dominated by crude oil exports and characterized by low value addition and limited diversification.

This finding is consistent with Ude and Agodi (2014), who reported that trade openness, has an insignificant impact on Nigeria's economic growth due to structural weaknesses in the export sector. Similarly, Adewuyi (2002) found that the benefits of trade liberalization in Nigeria are constrained by external dependence and domestic production limitations. However, the result with Sachs and Warner (1995) and other cross-country studies that found a strong positive relationship between openness and growth, suggesting that the gains from trade are conditional on structural and institutional factors.

Summary

This study examined the contribution of the blue economy to economic growth in Nigeria and assessed its viability as an investment frontier. Specifically, the study investigated the extent to which the blue economy influences economic growth and whether it possesses sufficient potential to justify increased investment by stakeholders. To achieve these objectives, the study employed the Autoregressive Distributed Lag (ARDL) framework using annual time series data spanning 1981 to 2024.

Pre-estimation results confirmed that the variables were integrated of mixed order, thereby validating the suitability of the ARDL technique. The bounds test for cointegration established the existence of a long-run relationship among economic growth, blue economy, gross fixed capital formation, labour force, and trade openness. The estimated error correction term was negative and statistically significant, indicating a moderate speed of adjustment from short-run disequilibrium to long-run equilibrium.

The empirical findings revealed that the blue economy, proxied by fisheries and water transport/storage, exerts a positive but statistically insignificant effect on economic growth in the current period. However, its lagged values were found to be positive and significant in the short run, while in the long run, the blue economy demonstrated a positive and statistically significant impact on economic growth. Gross fixed capital formation exhibited mixed effects in the short run but a negative and significant relationship with economic growth in the long run. Labour force displayed a positive but insignificant relationship in the short run, with its lagged values exerting a negative and significant effect, while in the long run, it contributed positively though weakly to economic growth. Trade openness was found to be positive but statistically insignificant in both the short and long run.

Conclusion

The study concludes that the blue economy constitutes a significant driver of economic growth in Nigeria, particularly over the long term. Although its impact is not immediate, the evidence suggests that investments in fisheries and water transport/storage yield positive growth outcomes after a period of adjustment. This underscores the importance of viewing the blue economy as a long-term strategic sector rather than a short-term growth stimulant.

However, the findings also reveal structural inefficiencies within the Nigerian economy. The negative long-run impact of gross fixed capital formation suggests that investment has not been effectively channeled into productive activities capable of enhancing output. Similarly, the weak contribution of labour reflects underlying challenges related to unemployment, underemployment, and inadequate human capital development. The insignificance of trade openness further indicates that the country has not fully leveraged the potential benefits of international trade, largely due to its dependence on primary commodity exports.

Taken together, the results highlight the need for a reorientation of economic policy towards improving the efficiency of traditional growth drivers while simultaneously harnessing the untapped potential of the blue economy. The study therefore affirms that the blue economy offers a viable pathway for economic diversification and sustainable growth in Nigeria.

Policy Recommendations

Based on the findings of the study, the following key policy recommendations are proposed.

i. The Federal Government should deliberately allocate more funds to the development of fisheries and inland water transport through annual budgets. This should include direct financing of modern fishing equipment, aquaculture expansion programmes, and rehabilitation of inland waterways.

ii. The government, through relevant agencies such as the Nigerian Ports Authority and National Inland Waterways Authority, should upgrade existing ports, dredge waterways, and develop new jetties and terminals. This will improve efficiency in water transport and enhance the contribution of the sector to GDP.

iii. The government should promote private sector participation by creating incentives such as tax holidays, subsidies, and concessional loans to attract private investors into blue economy sectors, particularly in fisheries processing, cold storage, and marine logistics.

iv. Given the negative impact of capital formation on growth, government should ensure that investments are directed toward productive sectors. This can be achieved through proper project appraisal, monitoring, and evaluation mechanisms to reduce waste and corruption.

v. The Ministry of Labour and relevant institutions should introduce vocational and technical training programmes focused on marine-related skills such as fishing technology, maritime operations, and logistics management. This will improve labour productivity and absorption.

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