RESEARCH ARTICLE

Energy Price, Maritime Trade and Economic Growth in Nigeria

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Abstract

Energy and maritime sectors are vital drivers of economic performance in resource-rich countries like Nigeria. However, fluctuations in energy prices and inefficiencies in maritime trade infrastructure pose challenges to sustainable growth. This study examined the relationship between energy prices, maritime trade, and economic growth in Nigeria. Data from 1990 to 2024 were used in the study which were estimated using the error correction technique. The findings showed that energy price has a positive and significant effect on economic growth in the longrun and short run. Maritime trade positively affect economic growth in the longrun and short run but not significant. There is a strong adjustment mechanism ensuring economic growth realign with its long-term equilibrium after a shock in the short-term based on the error correction term been negative and statistically significant. The study recommends that policymakers should prioritize investment in energy infrastructure to ensure stable and affordable energy supply. Emphasis need for diversifying energy sources and enhancing efficiency in energy distribution. The long run and short run positive effect of maritime trade on economic growth suggests that improving port infrastructure and enhancing maritime logistics can boost economic performance. Strategic development of seaport facilities and trade corridors for national economic priority.

Keywords: Energy Price; Maritime Trade; Economic Growth; ARDL; ECM

Introduction

Nigeria, as Africa's largest economy and a key player in the global energy market, faces a complex interplay between energy prices, maritime trade, and economic growth. The country is a major crude oil exporter but has historically relied on imported refined petroleum products due to insufficient domestic refining capacity (Nwabueze, Joel and Nwaozuzu, 2022). Recent developments, such as the operationalization of the Dangote Refinery in 2024, have begun reshaping Nigeria's energy landscape, reducing import dependency and altering trade dynamics in West Africa (NBS, 2025). However, fluctuations in global energy prices, inefficiencies in maritime logistics, and structural economic challenges continue to hinder Nigeria's growth trajectory (Akidi, Ikue and Ewubare, 2024). Several factors such as the Covid-19 pandemic (Ibn-Mohammed et al., 2021) and Russia-Ukraine war (Liadze, Macchiarelli, Mortimer-Lee and Juanino, 2023), has heavily affected the energy markets through reduction in demand for fossil fuel resources leading to lower prices. As opined by Simshauser, (2023) the Russia and Ukraine conflict contributed to the sharp increases in energy prices. Energy price shocks causes multiple problems including sharp increases in the unit costs of transportation and electricity generation needed for industrial production (Nguyen, Nong, Simshauser and Pham, 2024). These primary cost increases may then drive a cycle of production costs and output price rises throughout all sectors of the economy including construction, manufacturing, agriculture, food processing and services sectors (Nguyen et al, 2024). This in turn may drain public and private savings and incomes, as well as investment opportunities. Impacts on sectors and economies, however, are non-uniform, depending on economic structure, levels of reliance on fossil fuels, and trade (Balsalobre-Lorente et al., 2018; Hu et al., 2021; Usman et al., 2023). Maritime trade is a cornerstone of Nigeria's economy, facilitating over 80 percent of international trade and serving as a critical link to global markets (Adenigbo, Mageto and Luke 2023). The sector supports key industries, including oil and gas, agriculture, and manufacturing, but faces persistent challenges such as port congestion, outdated infrastructure, and security threats like piracy in the Gulf of Guinea (Adenigbo, et al, 2023). Meanwhile, energy price volatility-driven by global oil market trends, domestic subsidy reforms, and refining capacity constraints-has significant spillover effects on inflation, industrial productivity, and trade competitiveness (Akidi, et al, 2024). Nigeria's economy is heavily dependent on energy exports and maritime trade, yet both sectors face systemic challenges that constrain growth (Adenigbo, et al, 2023). Despite being a leading oil producer, the country struggles with refining inefficiencies, fuel subsidy removal shocks, and energy price instability, which exacerbate inflationary pressures and reduce industrial competitiveness (Akidi, et al, 2024). This study aims to bridge the gap in the extant literature in Nigeria bordering on the effect of energy price and maritime trade on economic growth.

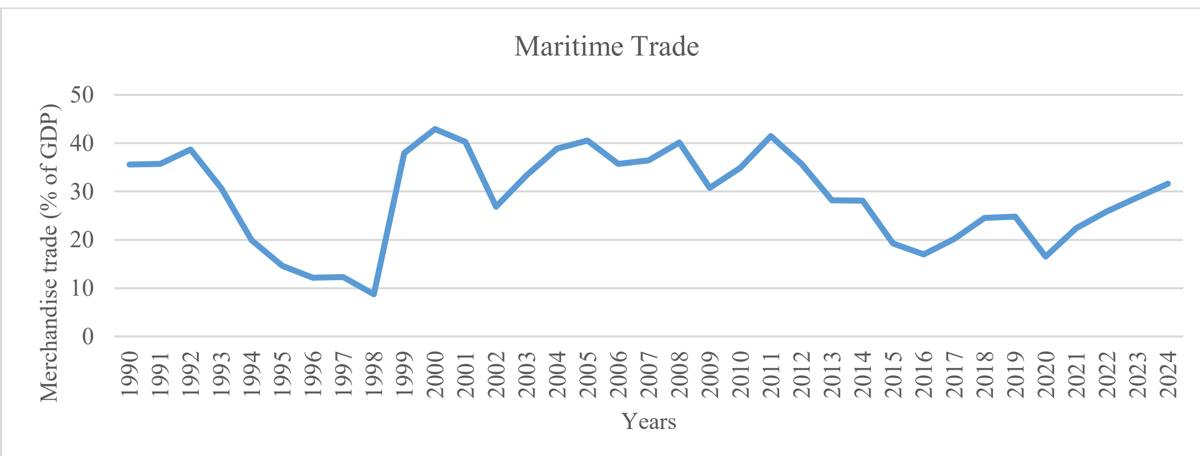

Figure 1. Maritime Trade Source: World Development Indicator, World Bank

Figure 1 shows the maritime trade as a percentage of GDP. A careful observation of the trend shows that it has been fluctuating over the study period with its highest value recorded in 2000 and the least within the study period been 1998. In figure 2, the energy price is presented, we can observe that there have been an upward trend in recent times which may be due to the increase in energy demand fueled by the increase in maritime trade and globalization. The least been 1998 and 2022 recording the highest during the study period.

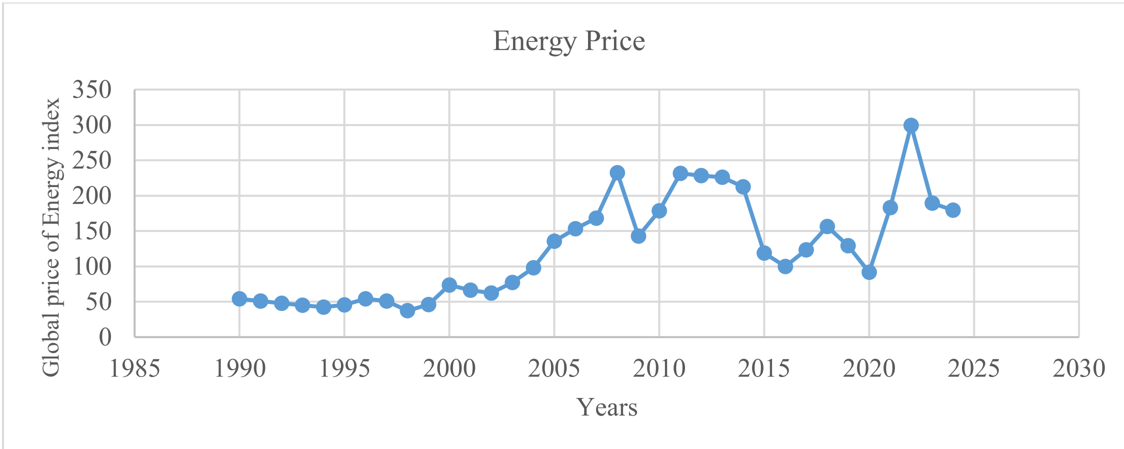

Figure 2. Energy Price Source: Federal Reserve Bank of St. Louis 2025

The research therefore seeks to investigate the effect of energy price, maritime trade on economic growth in Nigeria. The rest of the research is structured as follows; literature review is presented in section two, methodology in section three, result in section four and the conclusion and recommendations in section five.

Literature Review

Escalante and Mamboundou (2024), studied various instruments designed to mitigate the negative impacts of rising energy prices on the Portuguese economy. These instruments included enhancing purchasing power through wage increases, implementing cash transfers and subsidies, and reducing production taxes. Among these, lowering production taxes proved most effective, as it improved sectoral competitiveness and reduced supply prices. This focus on economic policy tools complements the findings of Mpojota (2024), who analyzed the role of international trade in driving GDP dynamics in Tanzania from 1991 to 2022. Using the Autoregressive Distributed Lag Error Correction model, Mpojota (2024) established both longrun and shortrun relationships between trade variables and GDP. The study highlighted that exports of goods and services significantly and positively impact GDP in the shortrun as do imports suggesting that trade openness and external sector engagement can cushion domestic shocks such as rising production costs. Nguyen et al. (2024) used the GTAP-E-PowerS model to assess how energy price increases affect regional economies, emissions and sectors. While the demand for renewables grew in response to higher prices, this shift was insufficient to fully offset economic losses, particularly in energy intensive sectors like manufacturing, transport and electricity generation. Real GDP was observed to decline significantly across most countries, reflecting systemic vulnerabilities to energy shocks. Turco et al. (2023) reinforced these insights through a macroeconomic analysis of energy price shocks in Europe. Their study identified elevated inflation as a core consequence, eroding purchasing power and slowing economic recovery. Policy interventions such as reduced energy taxes, price regulations and targeted subsidies were employed to buffer these effects. Notably, reduced tariffs were found to be cost effective in mitigating economic losses.

Adenigbo et al. (2023) evaluated the impact of shipping trade on Nigeria's economic growth from 1970 to 2020 using the Vector Error Correction Model. The study confirmed both shortrun and longterm causal relationships between trade variables (import, export and exchange rate) and GDP. However, the long-run findings revealed that while imports and exchange rates significantly influenced GDP, export volumes did not, underscoring Nigeria's import-dependence and export inefficiencies. Adding a different regional perspective, Sokhanvar and Lee (2023) observed that energy price shocks due to geopolitical conflicts contributed to currency appreciation in Canada, driven by the country's status as a major crude oil and natural gas exporter. This underscores how energy price dynamics can produce divergent macroeconomic effects depending on a country's export profile. Similarly, Perdana et al. (2022) employed a CGE model to explore the EU embargo on Russian fossil fuels and its ripple effects. The embargo, particularly on coal and crude oil, significantly raised energy prices and welfare costs across EU member states and affected household consumption in other regions highlighting the global interconnectedness of energy markets. Knez et al. (2022) by focusing on energy sustainability, analyzed the effects of various domestic energy prices (gasoline, gas, coal and solar) across 14 countries using panel data methods. Their findings indicated that coal price increases had the most detrimental impact on energy sustainability, whereas solar price increases had the least. Interestingly, gasoline prices had a positive effect and gas prices showed no significant impact. The study also confirmed the appropriateness of using a fixed effects model over a random effects model for such analysis.

Zhao et al. (2021) further contributed to the discourse by applying a recursive dynamic CGE model to China's economy. They found that oil price increases not only reduced real GDP but also spurred investment in renewable energy, consequently lowering emissions. Their results suggested that strategic investment in green energy can serve as a buffer against the adverse macroeconomic effects of fossil fuel price volatility. Opusunju et al. (2021) examined the relationship between manufactured exports and GDP in Nigeria from 1970 to 2019. Using regression analysis and correlation methods, the study revealed a positive and significant impact of manufacturing exports on economic growth. This supports the argument for export diversification as a means of strengthening economic resilience against global shocks like energy price surges.

Asymmetric Price Transmission (APT)

The study is anchored on the Asymmetric Price Transmission (APT) theory which was developed by economists using empirical evidence to describe and analyze price transmission in various markets. While there isn't a single developer or exact year for the Asymmetric Price Transmission (APT) theory, the concept began to gain significant attention in economic literature in the late 20th century, particularly in the 1980s and 1990s. Key contributors to the development and popularization of APT include researchers like Meyer and von Cramon-Taubadel (2004), who provided comprehensive reviews and analyses of asymmetry in price transmission. Asymmetric Price Transmission (APT) theory explored how prices at different stages of the supply chain (e.g., farm, wholesale, retail) respond differently to increases and decreases in input costs or market prices. Specifically, it examines situations where price adjustments are not symmetrical-prices might increase quickly in response to rising costs but decrease more slowly when costs fall (Meyer & von Cramon-Taubadel, 2004).

This is relevant for the study since Asymmetric Price Transmission (APT) theory examines how price changes in one sector, such as energy, are passed on to another sector, transportation and manufacturing, in an unequal manner (Akidi et al, 2024). This phenomenon is crucial in understanding the dynamics between energy prices and trade, especially given the significant role energy costs play in the manufacturing and transportation through the maritime corridor. Asymmetric Price Transmission (APT) theory suggests that prices do not adjust equally to positive and negative changes. An increase in energy prices can lead to an immediate and significant rise in goods and services due to the immediate impact on production and transportation costs.

Methodology

The expost facto research design was employed for the study. The multiple linear regression was used to analyse the data of the study. Data for the study was sourced from the World Development Indicator and Federal Reserve Economic Data, Federal Reserve Bank of St. Louis, the data will be from 1990 to 2024. The dependent variable is economic growth and independent variables are maritime trade (proxy by Merchandise trade as a percentage of GDP) and energy price (Global price of Energy index). The model formulated for the study will be estimated with the error correction technique.

The model for the study follows that of Gidwani (2022) and Adenigbo et al. (2023) with some modifications. The functional form of the model is given as;

$$GDP = f(EPR_t, MT_t) \qquad \text{Eq-(1)}$$

This ECM emphasizes both short-term dynamics and long-term adjustments, making it an effective tool for analyzing economic growth (GDP) in the context of energy price and maritime trade.

The error correction model is given as mentioned equation 2.

$$\Delta GDP = \beta_0 + \beta_1 \Delta EPR + \beta_2 \Delta MT + \theta ECM(-1) + \varepsilon_1 \qquad \text{Eq-(2)}$$

Where; GDP is gross domestic product which is a proxy for economic growth, MT is maritime trade, EPR is energy price, β_0 is the estimate of true intercept of the dependent variables or regression constant; β_1 and β_2 are the estimate of parameters of independent variables or Regression Coefficient. Δ is the first difference operator. ε_1 is the error term. θ measures the speed of adjustment.

Results and Discussions

The descriptive characteristics of the data used in the research is presented in table 1. It can be observed that GDP have an average of 3.3 which indicated that it on average the Nigerian economy stood at 3.3 billion dollars. Energy price (EPR) have an average of 123.78 dollars, indicating that the price of energy in the study period was over a hundred dollar. Maritime trade (MT) accounted for about 28.90 percent to the GDP of Nigeria on average. All the variables are platykurtic as indicated by their kurtosis values. GDP and EPR are positively skewed showing that most of their observations lies above their mean values, while MT has negative skewness, showing that most of its observations lies below its mean value. All the variables are normally distributed based on their Jarque-Bera probability values which are clearly greater than 0.05 level of significance.

Table 1. Descriptive Statistics

	GDP	EPR	MT
Mean	3.3000000000000	123.7767	28.90400
Median	3.1000000000000	118.9821	30.70465
Skewness	0.141519	0.538353	-0.431232
Kurtosis	1.404488	2.255128	2.070820
Jarque-Bera	3.829245	2.499772	2.343864
Probability	0.147397	0.286537	0.309768
Observations	35	35	35

Source: Author's computation with E-views, 2025. Note: GDP- Gross Domestic Product, EPR-Energy Price, MT-Maritime Trade

Table 2. ADF Unit Root Test

Variables	ADF Statistics (Level)	t-critical values (5%)	P-value	ADF Statistics (First Diff.)	t-critical values (5%)	P-value	Conclusion
GDP	0.13513	-2.954021	0.9637	-3.002785	-2.954021	0.0450	I(1)
EPR	-1.916840	-2.951125	0.3209	-6.192148	-2.957110	0.0000	I(1)
MT	-2.447830	-2.951125	0.1369	-4.519292	-2.957110	0.0011	I(1)

Source: Author's computation with E-views, 2025

The Augmented Dickey-Fuller unit root test was employed for testing for unit root in the data used for the study. The result is presented in table 2, and the variables are stationary at first difference. We therefore proceed to conduct the longrun model estimate and the error correction model.

Table 3. Long-run estimates.

Dependent Variable: GDP				
Variable	Coefficient	Std. Error	t-Statistic	Prob.
GDP(-1)	0.973240	0.015128	64.33534	0.0000
EPR	1.250000	31785771	3.947715	0.0004
MT	1.620000	1.670000	0.969826	0.3399
C	3.290000	6.060000	0.054272	0.9571
R-squared	0.997508	Mean dependent var		3.350000
Adjusted R-squared	0.997259	S.D. dependent var		1.490000
F-statistic	4003.547	Durbin-Watson stat		1.700702
Prob(F-statistic)	0.000000			

Source: Author's computation with E-views, 2025.

The longrun model estimates are presented in Table 3. The coefficient 0.973240 suggests that, holding other factors constant, a one percent rise in one period lag of GDP causes a 0.97 unit drop in current GDP. Energy price has a positive and significant effect on economic growth. Thus, a 1% rise in energy price would cause a 1.25 unit increase economic growth. Maritime trade positively affect economic growth, a one percent rise in the maritime trade will result in a 1.62 unit rise in economic growth. The R-squared of 0.903735 shows that the model is best fit, which indicates that the independent variables (GDP(-1), MT and EPR) explain 99 percent of the variation in economic growth. There is joint significance among the variables of the study indicated by F-statistic probability value of 0.000000. The Durbin-Watson statistic 1.7 indicates that there is no evidence of autocorrelation in the residuals.

Table 4. Error correction model

Dependent Variable: GDP				
Variable	Coefficient	Std. Error	t-Statistic	Prob.
D(GDP(-1))	1.083083	0.184634	5.866094	0.0000
D(EPR)	92245454	32665466	2.823944	0.0086
D(MT)	43144003	1.890000	0.228240	0.8211
ECM(-1)	-0.923269	0.267091	-3.456756	0.0018
C	-9.650000	2.620000	-0.368972	0.7149
R-squared	0.573966	Mean dependent var		1.250000
Adjusted R-squared	0.513104	S.D. dependent var		1.060000
F-statistic	9.430604	Durbin-Watson stat		2.097696
Prob(F-statistic)	0.000059			

Source: Author's computation with E-views, 2025. ECM- Error Correction Term

Table 4 showed the estimates of the error correction model. The coefficient of 1.08 suggests that a one percent rise in one period lag GDP value causes a 1.1 unit increase in current GDP in the shortrun. Also, in the shortrun, energy price has a positive and significant effect on economic growth. This indicates that a 92245454 unit increase in economic growth would result from a one percent rise in energy price. In the shortrun, maritime trade has a positive effect on economic growth; a one percent rise in maritime trade in the economy will result in a 43144003 percent rise in economic growth. Being negative and statistically significant, the error correction term -9.65 aligns with econometric theory. This suggests the rate of return to equilibrium. Hence, about 9.6 percent of the disequilibrium in economic growth is corrected in the next period. There is a strong adjustment mechanism ensuring economic growth returns to its long-term equilibrium after short-term shocks. The R-squared of 0.573966 suggests that 57 percent of the variation in economic growth is explained by the independent variables (EPR, MT and the ECT) which is indicative of a good fit for the model. The F-statistic probability value shows the model is highly significant. The Durbin-Watson statistic 2.09 showed no evidence of serial-correlation in the residuals.

Table 5. Pairwise Granger Causality test

Null Hypothesis:	Obs	F-Statistic	Prob.
EPR does not Granger Cause GDP	34	15.8052	0.0004
GDP does not Granger Cause EPR		2.51735	0.1227
MT does not Granger Cause GDP	34	8.99322	0.0053
GDP does not Granger Cause MT		0.08853	0.7680
MT does not Granger Cause EPR	34	0.00093	0.9758
EPR does not Granger Cause MT		0.10747	0.7452

Source: Author's computation with E-views, 2025

The Pairwise Granger Causality test result presented in table 5, shows that energy price and maritime trade granger causes economic growth. Although, economic growth does not granger causes any of them. There is also no granger causal relationship between energy price and maritime trade.

Diagnostic tests

The variance inflation factor is used to test for multicollinearity, the result showed that the model estimated for the study is free from multicollinearity as the centered VIF is less than 10.

Table 6. Variance Inflation Factor (VIF)

Variable	Coefficient Variance	Uncentered VIF	Centered VIF
GDP(-1)	0.000229	15.97147	2.660158
EPR	1.010000	11.74046	2.809849
MT	2.800000	14.31413	1.423639
C	3.670000	20.50339	NA

Source: Author's computation with E-views, 2025

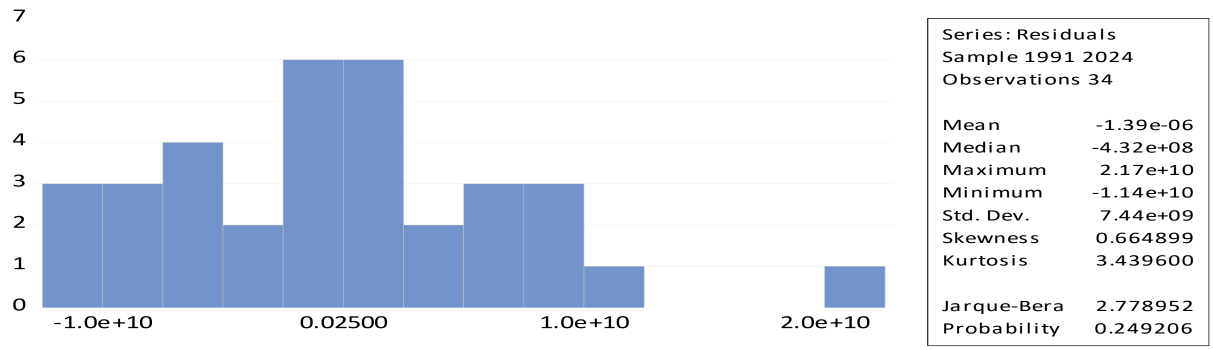

Figure 3. Normality test

Source: Author's computation with E-views, 2025

The normality test is conducted with the Jarque-Bera statistic. The result is presented in figure 3. The probability value 0.249206 shows that the residuals of the model are normally distributed.

Table 7. Breusch-Godfrey Serial Correlation LM Test

Null hypothesis: No serial correlation at up to 1 lag			
F-statistic	0.528010	Prob. F(1,29)	0.4733
Obs*R-squared	0.607976	Prob. Chi-Square(1)	0.4356

Source: Author's computation with E-views, 2025

Table 8. Heteroskedasticity Test: Breusch-Pagan-Godfrey

Null hypothesis: Homoskedasticity			
F-statistic	0.046635	Prob. F(3,30)	0.9864
Obs*R-squared	0.157824	Prob. Chi-Square(3)	0.9841
Scaled explained SS	0.149881	Prob. Chi-Square(3)	0.9852

Source: Author's computation with E-views, 2025

The estimated model is free from serial correlation and heteroskedasticity based on their test results presented in table 7 and table 8 respectively which are greater than 0.05.

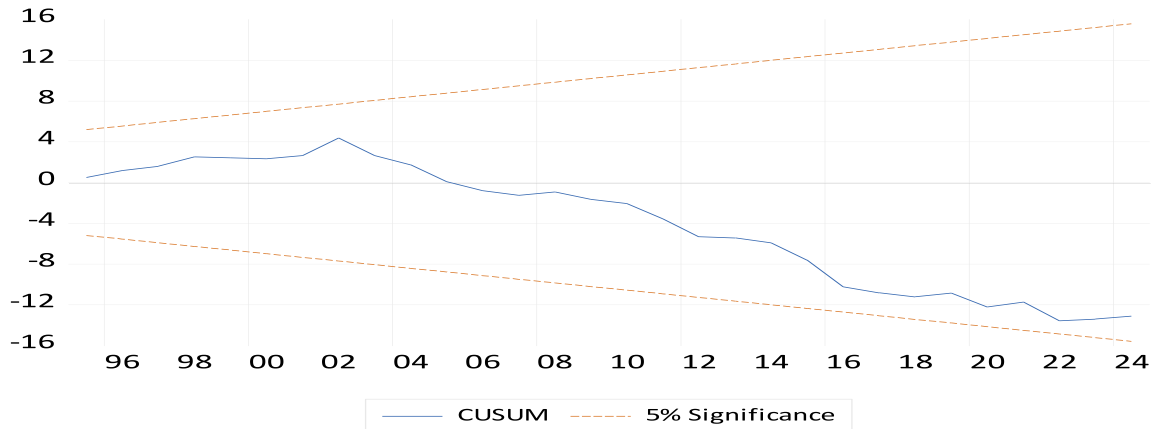

Figure 4. CUSUM

Source: Author's computation with E-views, 2025

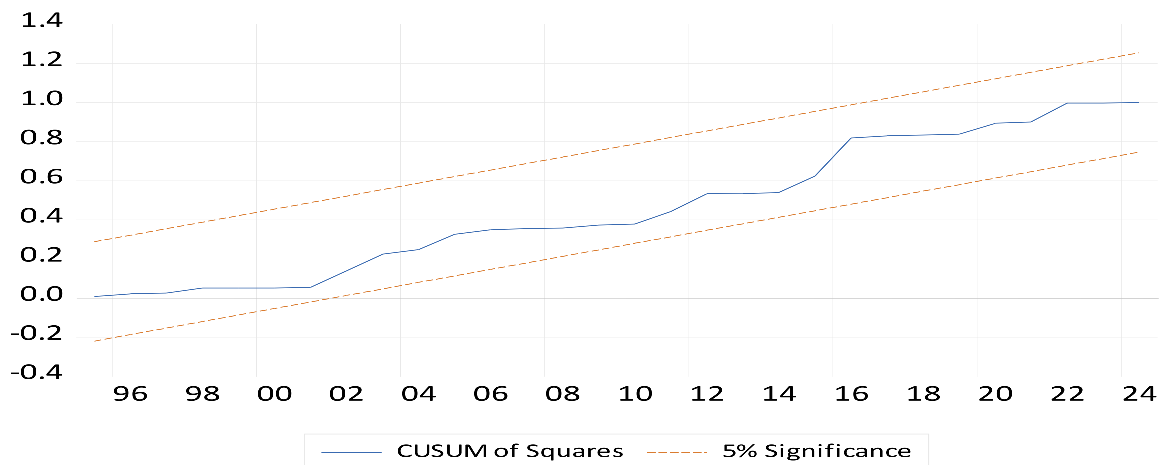

Figure 5. CUSUMQ

Source: Author's computation with E-views, 2025

The stability tests conducted for the model is presented in figure 4 and figure 5. Both the CUSUM and the CUSUM of Squares test shows that the model is stable and can be relied on to make policies on energy price, maritime trade and economic growth in Nigeria.

Conclusions

The study examined the relationship between energy prices, maritime trade, and economic growth in Nigeria, analyzing both long-run and short-run dynamics. The results revealed that energy prices have a positive and significant impact on economic growth in both the long run and short run, suggesting that energy, despite its cost plays a crucial role in sustaining and stimulating economic activity. Similarly, maritime trade positively influences economic growth both in the long run and short run, underscoring the strategic importance of maritime trade to the economy. The error correction mechanism indicates the resilience of economic growth in realigning with its long-term equilibrium. Based on the findings therefore, the study opined that the positive and significant effect of energy prices in driving economic growth, indicates that policymakers should prioritize investment in energy infrastructure to ensure stable and affordable energy supply. Emphasis should be placed on diversifying energy sources and enhancing efficiency in energy distribution. The long-run and short run positive effect of maritime trade on economic growth suggests that improving port infrastructure, streamlining port operations, and enhancing maritime logistics can boost economic performance. Strategic development of seaport facilities and trade corridors should be considered a national economic priority.

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Authors contribution: Porwekobowei Aruwei and Dubem Victor Enaruna both contributed to the conceptualization, data collection and analysis of the study. Specifically, Porwekobowei Aruwei provided support in data analysis, interpretation and contributed to the manuscript's critical revision. All authors reviewed and approved the final manuscript.

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