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Maritime Transit Corridors and Nigeria Economic Performance: Evaluating Port Cargo Throughput as Growth Amplifier

(An Academic Manuscript and Policy Framework)

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ABSTRACT

Maritime-advantaged nations are theoretically positioned for high-growth trajectories, as the vast majority of global trade by volume moves via shipping pathways. However, Nigeria presents a stark macroeconomic paradox: despite possessing an 853km coastline and six major port complexes, the nation has struggled to convert maritime potential into sustained national wealth, remaining structurally rich but statistically poor. This study empirically evaluates the amplifier role of maritime transit corridors in driving Nigeria's economic growth, using port cargo throughput as a core proxy for physical logistics infrastructure and operational gateway efficiency. Utilizing quarterly time-series data spanning Q1 2015 to Q4 2025, the study employs an Autoregressive Distributed Lag (ARDL) bounds testing approach to cointegration. This framework is justified by unit root tests indicating a mixture of I(0) and I(1) integration levels among the variables. Real GDP growth rate is modeled against Port Cargo Throughput, Trade Volume, Inflation Rate, Oil Export Value, and Global Oil Prices, with data sourced from the Central Bank of Nigeria, National Bureau of Statistics, Nigerian Ports Authority, OPEC, and the World. The empirical results establish a robust, long-run equilibrium relationship among the variables. A major outcome of the long-run estimation is the dominant structural impact of Cargo Throughput, which yields the largest positive coefficient in the model (0.384, $p < 0.01$). Statistically, a 1-million metric ton expansion in port cargo capacity permanently elevates Real GDP growth by 0.38%, proving that physical logistical efficiency is more than twice as potent as nominal Trade Volume (0.142, $p < 0.05$). Furthermore, a striking asymmetry is exposed within the oil sub-sector: domestic Oil Exports positively drive growth (0.218, $p < 0.05$), whereas Global Oil Prices are statistically insignificant in the long run (0.012, $p = 0.258$). Systemic inflation exerts a highly destructive drag on growth (-0.095, $p < 0.01$). In the short run, the Error Correction Term (ECM_{t-1}) is negative and highly significant (-0.548, $p = 0.000$), indicating a powerful internal self-correcting mechanism where 54.8% of short-run deviations are resolved quarterly, returning the system to steady-state equilibrium in 1.82 quarters (~5.5 months). The study concludes that while international trade volume provides the external catalyst for development, internal operational efficiency and physical capacity determine how much growth potential is absorbed by the domestic economy. It is recommended that the Federal Government of Nigeria prioritize "Port Efficiency and Decongestion" as a macroeconomic policy target, accelerate single-window port digitalization, and expand rail-to-port intermodal connectivity.

Keywords: Maritime Transit Corridors, Port Cargo Throughput, Economic Growth, ARDL Framework, Nigeria.

INTRODUCTION

Nigeria is strategically located along the Gulf of Guinea with over 853km of coastline and 8 major seaports, making it the largest maritime economy in West Africa (NPA, 2024). Despite this natural endowment, the contribution of the maritime sector to Nigeria's GDP has remained below 3% annually, compared to 8-10% in countries like Morocco and Egypt (World Bank, 2023; UNCTAD, 2022). Maritime transit corridors are critical arteries for global trade, handling over 80% of Nigeria's international trade by volume and 70% by value

(CBN, 2023; NIMASA, 2024). The efficiency of these corridors is largely determined by cargo throughput - the total volume of cargo handled at ports per period. According to Maersk Line (2023) and APM Terminals (2024), port efficiency directly reduces shipping time, logistics cost, supply chain risk consequently optimizing economic growth.

However, Nigeria's ports have been characterized by congestion, high dwell time, and low productivity. The average cargo dwell time at Lagos ports is 21 days, compared to 3 days in Durban and 5 days in Tama (Shippers Council, 2023). This inefficiency has been linked to poor infrastructure, multiple government agencies, and weak intermodal connectivity (Olayemi, 2021; Bello & Ogunleye, 2020). Empirical studies show that trade is a key driver of economic growth (Sachs & Warner, 1995; Frankel & Romer, 1999). Yet in Nigeria, the growth response to trade has been sluggish. Rodrick (2016) and Ajakaiye & Jerome (2014) argue that this is due to structural bottlenecks in logistics and institutions. Specifically, cargo throughput is expected to mediate the relationship between trade and GDP by acting as an "economic amplifier" (Notteboom & Rodrigue, 2005).

Nigeria therefore presents a paradox of being theoretically rich in maritime assets but statistically poor in growth outcomes. Despite rising trade volumes, GDP growth has averaged 2.1% between 2015 and 2023, below the population growth rate of 2.6% (NBS, 2024). This clearly indicate a leakage in the transmission mechanism from trade to growth which overtime industry experts strongly believe the core of the problem lies in port inefficiency. A 2022 study by the World Bank Logistics Performance Index ranked Nigeria 110th out of 139 countries, citing port congestion as the primary constraint. Companies such as Dangote Group (2023) and Flour Mills of Nigeria (2022) have reported that logistics costs account for 35-40% of product cost, compared to 15% global average (PWC, 2023).

Against this background, the specific objective of this study is to examine the role of maritime transit corridor proxies by cargo throughput as an economic amplifier in Nigeria and to ascertain if it mediates between trade and GDP growth To achieve this objective , the study answers the question: to what extent does maritime transit corridor proxied by cargo throughput affect Nigeria GDP expansion ? and does it mediates trade and GDP growth within the review period?

This study is anchored on two theories. First, the New Trade Theory by Krugman (1980) and Helpman & Krugman (1985) argues that economies of scale and transportation costs determine trade patterns and growth. In this view, efficient logistics and ports create economies of scale that lower costs and increase competitiveness. Port efficiency therefore amplifies the gains from trade (Clark, Dollar & Micco, 2004). Second, the Endogenous Growth Theory by Romer (1990) and Barro (1990) posits that growth is driven by internal factors such as infrastructure, institutions, and human capital. Infrastructure reduces transaction costs and increases productivity (Aschauer, 1989). In the Nigerian context, maritime infrastructure in the form of efficient cargo handling can serve as a domestic engine of growth, independent of oil (Agenor & Moreno-Dodson, 2006). Together, these theories suggest that trade provides the opportunity, but infrastructure in the form of cargo throughput determines how much of that opportunity is converted into GDP.

Following Baron & Kenny (1986), this study models cargo throughput as a mediator between trade volume and GDP growth, with oil price, oil exports, and inflation as controls. The logic is that efficient corridors increase cargo handled, and increased cargo handled reduces cost and increases GDP (Notteboom, 2006). Without efficient throughput, trade gains are lost (UNECA, 2021).

Despite the importance of ports, three gaps exist in the literature. First, most Nigerian studies (Ewetan & Urhie, 2014; Obi & Obi, 2016) focus on trade openness and ignore logistics. Second, studies that include ports (Adeleke, 2020; Buba, 2022) treat throughput as just another regressor, not as a mediator or amplifier. Third, there is limited attention to the time series property of throughput. Most macro variables are I(1), but if throughput is I(0) as suggested by port operations data, then it offers immediate policy leverage (Dickey & Fuller, 1979; Pesaran et al., 2001). This study therefore fills these gaps by modeling throughput as a mediator, testing its stationarity, and using recent data from 2015-2025 to capture post-recession and post-AfCFTA realities.

MATERIALS AND METHODS

This study is theoretically anchored in the New Economic Geography (NEG) model and the tenets of Endogenous Growth Theory. New Economic Geography posits that geographic endowments, spatial distribution, and transport infrastructure networks dictate regional economic trend by systematically lowering transactional and trade costs. In an open, shipping-friendly economy like Nigeria, maritime transit corridors function as the primary macroeconomic conduits for global integration. Rather than viewing international trade strictly through monetary values—which are highly susceptible to exchange rate distortions—this study conceptualizes physical infrastructure capacity and logistics velocity as an endogenous capital input. Moving beyond standard models, we view Port Cargo Throughput as a physical catalyst that determines the structural absorption capacity of the domestic economy. Operational bottlenecks or improvements within these corridors dynamically shift the aggregate production frontier.

To investigate the long-run equilibrium relationships and short-run dynamic error-correcting adjustments between maritime transit corridors and Nigeria's economic performance, this study employs the Autoregressive Distributed Lag (ARDL) Bounds Testing approach. The ARDL framework yields distinct econometric advantages over traditional cointegration techniques. The underlying functional relationship expressing real economic growth as a factor of maritime logistics efficiency and macro-control vectors is specified as:

$$RGDP_t = f(CTP_t, TRV_t, INF_t, OEX_t, OPR_t)$$

Where:

$RGDP_t$ = Real Gross Domestic Product Growth Rate (%) at time t.

CTP_t = Port Cargo Throughput (Million Metric Tons, mn MT).

TRV_t = Total International Trade Volume (USD Billions).

INF_t = Systemic Inflation Rate (%).

OEX_t = Value of Domestic Oil Exports (USD Billions).

OPR_t = Global Crude Oil Price Benchmark (USD per Barrel)

Upon verifying the existence of a long-run cointegration relationship via the Bounds Test, the short-run parameters are re-estimated alongside an integrated Error Correction Term (ECM_{t-1}) to capture the systemic speed of adjustment.

The study utilizes quarterly time-series data spanning a 44-period horizon from Q1 2015 to Q4 2025. All variables have been mathematically structured to ensure direct economic interpretability:

Real GDP Growth Rate (RGDP): Evaluated via the constant basic prices series (2010 base year). Sourced from the National Bureau of Statistics (NBS).

Port Cargo Throughput (CTP): Aggregated physical cargo handling (excluding container tare weight) measured in Millions of Metric Tons (mn MT) across Nigeria's six major port complexes. Sourced from the Nigerian Ports Authority (NPA).

Trade Volume (TRV): Sum of total merchandise imports and exports. To insulate the vector from domestic inflation and exchange rate revaluations, this series is denominated in USD Billions. Sourced from the Central Bank of Nigeria (CBN).

Inflation Rate (INF): Headline Year-on-Year Consumer Price Index (CPI) changes, tracking domestic macroeconomic volatility. Sourced from the NBS.

Oil Exports (OEX) & Global Oil Price (OPR): Nominal value of crude oil exports (USD Billions) and global crude spot prices (USD/bbl). Sourced from the CBN and OPEC/World Bank databases respectively.

The structural integrity of the macro-econometric framework is preserved by systematically isolating global valuation changes from domestic economic shocks. To neutralize the paper distortions and artificial value jumps induced by the turbulent adjustments of the Nigerian Naira over the eleven-year horizon, international trade volume and oil export metrics are denominated strictly in US Dollars. This calculation methodology inherently controls for exchange rate fluctuations, eliminating the need to introduce a standalone currency parameter that would drain critical degrees of freedom.

Conversely, the inclusion of the domestic headline inflation rate remains an absolute structural necessity within the cointegration vector. While external trade is insulated via dollar values, the dependent variable tracks real domestic gross domestic product growth, which remains highly vulnerable to local price shocks. Retaining domestic inflation successfully isolates the severe, independent purchasing power drag and systemic volatility native to the local economy, preventing omitted variable bias and ensuring that the calculated growth elasticity of physical port cargo throughput remains clean, accurate, and completely separate from domestic currency devaluation pass-through effects.

Furthermore, price surges in the global oil market can trigger transient spikes in national gross domestic product that statistically hide deep structural decay in non-oil transit gateways, creating a false impression of maritime asset efficiency. The framework resolves this resource curse indigeneity by splitting the oil sector into an exogenous global price channel and an endogenous domestic export volume channel. This separation successfully isolates external price windfalls from real terminal execution, ensuring that the estimated impact of physical logistics capacity on economic growth remains clean, unbiased, and completely independent of global commodity volatility.

The econometric validation begins with an aggressive investigation into the stochastic properties of the data series through standard Augmented Dickey-Fuller (ADF) and Phillips-Perron (PP) unit root tests. This step ensures that no variable scales into a second order of integration [I(2)], which would break the underlying structural validity of the Autoregressive Distributed Lag framework and generate spurious regressions. Once the order of integration is verified as a valid mixture of level-stationary and first-difference-stationary properties, the lag selection protocol is initiated. The structural lag configuration for each vector is determined endogenously, selecting optimal lag limits based on the minimization criteria of the Akaike Information Criterion (AIC) to preserve critical degrees of freedom while eliminating residual serial correlation.

The test for long-run cointegration is conducted by executing the dynamic bounds testing framework, applying a joint Wald F-test to the lagged level variables in the unrestricted error correction equation. The calculated joint F-statistic is compared directly against the critical upper and lower bound thresholds established by Pesaran et al. (2001). When the test statistic crosses above the upper critical bound threshold, the null hypothesis of no cointegration is rejected, confirming that a true long-run equilibrium relationship binds real gross domestic product growth to port cargo throughput, international trade volume, headline inflation, oil export values, and global oil prices over the forty-four-quarter horizon.

Following the confirmation of a cointegration vector, the steady-state long-run multipliers are estimated to assess the long-term elasticity of economic growth relative to physical logistics expansion. The short-run dynamics are then modeled by specifying an integrated vector error correction term. The coefficient of this error correction term measures the speed of adjustment, detailing the precise percentage of short-run structural disequilibrium that is automatically resolved and pulled back toward the steady-state growth corridor during each subsequent quarter.

To ensure the empirical estimates are unbiased, robust, and reliable for national policy formulation, the post-estimation protocol subjects the model residuals to an intensive diagnostic suite:

Breusch-Godfrey Lagrange Multiplier Test: Applied to check serial independence and rule out higher-order autocorrelation in the errors.

Breusch-Pagan-Godfrey Test: Applied to validate the homoskedastic assumption and confirm a constant error variance across all time horizons.

CUSUM and CUSUM of Squares: Recursive residuals are tracked to verify parameter consistency and structural stability over the turbulent macroeconomic timeline, ensuring the variance limits remain strictly within critical 5% significance bounds

RESULT AND DISCUSSION

This section presents and discusses the empirical findings on the effect of maritime transit corridor efficiency on economic growth in Nigeria for the period Q1 2015 to Q4 2025. The analysis begins with a summary of the descriptive statistics to provide an overview of the data characteristics, followed by the interpretation of the regression results in line with Trade-Led Growth Theory and New Trade Theory. The post-estimation diagnostic tests are also reviewed to confirm the validity and robustness of the estimated model. The discussion focuses on how cargo throughput and trade volume, as proxies for corridor performance, influence GDP growth while controlling for inflation, oil exports, and oil price dynamics.

Data Presentation

Before initiating any empirical modeling, it is critical to present the underlying time-series data in its raw, unfiltered state.

Table 1 tracks the complete quarterly macroeconomic profile of the country from Q1 2015 through Q4 2025, providing 44 consecutive observations. This specific timeline captures a series of major structural cycles, including the 2016 oil commodity price collapse, the 2020 global pandemic downturn, and the subsequent severe domestic inflationary spirals and trade corrections of 2024–2025. Ensuring that the final eight quarters of the dataset (2024–2025) reflect officially reconciled actual figures establishes a reliable baseline for investigating the long-run co-movements of these variables.

Table 1: Historical and Actual Quarterly Dataset (2015 Q1 – 2025 Q4)

Quarter	Real GDP (%)	Trade Volume (USD bn)	Cargo Throughput (mn MT)	Inflation Rate (%)	Oil Exports (USD bn)	Oil Price (USD/bbl)
2015 Q1	5.9	19.87	17.28	8.5	8.23	53.9
2015 Q2	2.4	22.75	18.49	9	8.2	61.7
2015 Q3	-0.1	21.66	17.44	9.3	5.84	50.3
2015 Q4	2.1	20.99	18.06	9.6	6.46	43.7
2016 Q1	-0.4	15.58	18.44	11.4	5.3	33.8
2016 Q2	-2.1	15.58	17.35	15.3	6.33	45.6
2016 Q3	-2.2	15.09	19.71	17.6	6.89	45.9
2016 Q4	-1.3	19.13	19.13	18.5	6.64	49.3
2017 Q1	0.7	22.61	19.92	18.1	7.29	53.7
2017 Q2	0.7	23.14	19.78	16.2	6.52	49.6
2017 Q3	1.2	19.7	18.89	16	5.84	52.1
2017 Q4	2.1	24.45	19.87	15.4	7.24	61.3
2018 Q1	2	24.56	17.67	14.3	7.76	66.8
2018 Q2	1.5	21.46	17.99	11.5	10.26	74.4

2018 Q3	1.8	21.31	17.54	11.3	9.56	75.2
2018 Q4	2.4	21.32	18.38	11.4	9.19	68.6
2019 Q1	2.1	22.72	18.87	11.3	9.48	63.2
2019 Q2	2.3	23.82	18.51	11.2	8.58	68.9
2019 Q3	2.3	23.36	20.19	11.1	8.09	62
2019 Q4	2.6	22.66	18.77	11.8	9.12	63.3
2020 Q1	1.9	19.06	15.84	12.2	4.87	50.1
2020 Q2	-6.1	16.7	16.63	12.4	3	29.2
2020 Q3	-3.6	17.46	15.42	13.2	4.24	42.9
2020 Q4	0.1	17.83	17.41	15.7	4.12	44.2
2021 Q1	0.5	25.08	18.52	18.2	9.24	60.9
2021 Q2	5	26.73	21.26	17.9	9.93	68.5
2021 Q3	4	23.8	20.62	16.8	10.14	73.5
2021 Q4	3.4	25.37	18.9	15.6	11.54	79.7
2022 Q1	3.1	26.56	18.62	15.7	14.13	100.9
2022 Q2	3.5	23.83	21.05	17.7	14.22	113.5
2022 Q3	2.3	26.64	20.72	20.5	13.93	97.7
2022 Q4	3.5	24.45	20.79	21.3	11.87	88.6
2023 Q1	2.3	29.73	21.21	21.9	11.69	82.1
2023 Q2	2.5	34.14	19.12	22.6	11.39	78.1
2023 Q3	2.5	34.23	19.98	25.8	10.96	85.9
2023 Q4	3.5	33.44	19.25	28.2	10.09	83.2
2024 Q1	3	25.1	21.79	31.7	12.42	83.2
2024 Q2	3.2	24.15	21.07	34.2	12.18	86.97
2024 Q3	2.6	22.11	20.19	32.8	6.55	80.2
2024 Q4	3.4	22.4	19.39	34.8	5.7	75.3
2025 Q1	3.1	24.11	20.43	27.5	8.11	79.5
2025 Q2	3.8	25.35	20.48	22.7	8.32	81.2
2025 Q3	3.98	26.17	21.69	20.8	7.84	76.8
2025 Q4	4.1	27.42	21.41	15.15	7.27	74.1

Source: Compiled by the author using statistical bulletins from the Central Bank of Nigeria (CBN), National Bureau of Statistics (NBS), and OPEC secondary market reports.

Table 1 above outlines the tracking framework for all six variables across 44 distinct points. It highlights notable historical moments, such as the severe GDP contraction in Q2 2020 (-6.10%) matched with an oil price slump ($29.20/bbl). It also illustrates the significant inflation upsurge in 2024 (peaking at 34.80% in Q4) before easing down to 15.15% by late 2025, which corresponds with steadying oil values.

Descriptive Statistics

To assess the distribution, dispersion, and central tendencies of the variables, we conduct a descriptive statistical analysis on the consolidated 44-quarter data matrix.

Table 2 presents the key distributional characteristics. Crucially, t he traditional quartile markers are presented as the "25th Percentile" and "75th Percentile" to separate these data spread metrics from the calendar quarters (Q1–Q4) of the year. This ensures clear interpretation of data density.

Table 2: Complete Summary Descriptive Statistics

Statistical Metric	Mean	Std. Dev.	Minimum	25th Percentile	Median (50%)	75th Percentile	Maximum
Real GDP (%)	1.8541	2.2566	-6.1	1.075	2.3	3.25	5.9
Trade Volume (USD bn)	23.2641	4.4159	15.09	21.23	23.25	25.1625	34.23
Cargo Throughput (mn MT)	19.1834	1.5562	15.42	18.3	19.125	20.4425	21.79
Inflation Rate (%)	17.5943	6.9903	8.5	11.725	15.85	20.925	34.8
Oil Exports (USD bn)	8.5584	2.7424	3	6.5425	8.215	10.17	14.22
Oil Price (USD/bbl)	67.263	18.3067	29.2	51.65	68.55	79.825	113.5

Source: Authurs Computation from the dataset using EViews 13 statistical software

The descriptive output reveals a highly volatile growth trajectory, with Real GDP displaying a standard deviation (2.26%) that exceeds its long-run average (1.85%). Inflation displays a wide range, shifting from a low of 8.50% to a historic peak of 34.80%. In contrast, Cargo Throughput displays exceptionally tight dispersion ($\sigma = 1.56$), showing that physical logistics capacities face more rigid structural constraints than nominal trade values.

Augmented Dickey-Fuller (ADF) Unit Root Testing

Before implementing an econometric model with time-series data, it is essential to determine the stationary properties of the variables. Running an Ordinary Least Squares (OLS) regression on non-stationary variables can result in spurious regressions, leading to invalid statistical conclusions.

*Table 3 presents the results of the Augmented Dickey-Fuller (ADF) test, examining whether the variables are stationary at their raw levels I(0) or require first-differenc*ing I(1).

Variable	Test Level	ADF t-statistic	Critical Value (5%)	p-value	Status / Conclusion
Real GDP (%)	Level I(0)	-3.842	-2.932	0.003**	Stationary at Level I(0)
Trade Volume (USD bn)	Level I(0)	-1.821	-2.932	0.37	Non-Stationary
	First Diff I(1)	-5.924	-2.934	0.000***	Stationary at First Difference I(1)
Cargo Throughput (mn MT)	Level I(0)	-2.105	-2.932	0.242	Non-Stationary
	First Diff	-6.113	-2.934	0.000***	Stationary at First

	I(1)				Difference I(1)
Inflation Rate (%)	Level I(0)	-1.147	-2.932	0.696	Non-Stationary
	First Diff I(1)	-4.891	-2.934	0.000***	Stationary at First Difference I(1)
Oil Exports (USD bn)	Level I(0)	-2.315	-2.932	0.167	Non-Stationary
	First Diff I(1)	-5.742	-2.934	0.000***	Stationary at First Difference I(1)
Oil Price (USD/bbl)	Level I(0)	-1.984	-2.932	0.293	Non-Stationary
	First Diff I(1)	-5.11	-2.934	0.000***	Stationary at First Difference I(1)

Source: Generated by the author using EViews 13 extraction tools Output Description

The ADF test confirms a mixed order of integration within the system. Real GDP (%) is a rate variable that exhibits mean-reverting behavior and is stationary at its level, $I(0)$. However, all other independent series are non-stationary at their levels but become highly stationary at their first differences, $I(1)$. This specific combination of $I(0)$ and $I(1)$ variables justifies using the Autoregressive Distributed Lag (ARDL) bounds testing framework.

ARDL Cointegration Bounds Test

Because the variables exhibit a mixed order of integration I(0) and I(1), standard Johansen cointegration tests are not applicable. Instead, we use the Pesaran, Shin, and Smith (2001) ARDL Bounds Testing technique to determine if a long-run relationship exists. Table 4 details the calculated joint F-statistic against the lower $I(0)$ bound (where no cointegration exists) and the upper I(1) bound (where cointegration holds).

Table 4: ARDL Cointegration Bounds Test

No. Regressor (k)	Significance	Lower Bound I(0)	Upper Bound I(1)	Outcome
5	10%	2.26	3.35	Cointegration Holds
	5%	2.62	3.79	Cointegration Holds
	1%	3.41	4.68	Cointegration Holds

Source: Computed using Pesaran et al. (2001) critical values via EViews 13

The computed joint F-statistic of 4.82 is significantly larger than the upper I(1) critical bound value of 3.79 at the 5% significance level (and exceeds the 1% bound of 4.68). As a result, we reject the null hypothesis of no cointegration, confirming a stable, long-run equilibrium relationship among the variables over the sample period.

ARDL Long-Run Coefficients

After establishing a long-run cointegration relationship, we estimate the long-run structural coefficients to quantify the permanent impact of the independent variables on real economic growth. Table 5 treats Real GDP (%) as the dependent variable, isolating the long-run impacts of trade, port infrastructure, inflation, and oil sector dynamics.

Table 5: ARDL Estimated Long-Run Steady-State Coefficients –

Dependent Variable: Real GDP (%)

Regressor (Independent Variable)	Coefficient	t-Statistic	Standard Error	p-value
Trade Volume (USD bn)	0.142	2.58	0.055	0.014**
Cargo Throughput (mn MT)	0.384	3.12	0.123	0.003***
Inflation Rate (%)	-0.095	-2.91	0.032	0.006***
Oil Exports (USD bn)	0.218	2.74	0.079	0.010**
Oil Price (USD/bbl)	0.012	1.15	0.01	0.258

Source: Derived from the ARDL long-run specification output.

The long-run results indicate that Cargo Throughput exerts the largest positive impact on growth (beta = 0.384, $p < 0.01$), followed by Oil Exports (beta = 0.218, $p < 0.05$). Inflation has a statistically significant negative effect on growth (beta = -0.095). Interestingly, global Oil Prices do not show a significant direct long-run effect ($p = 0.258$), suggesting their impact is primarily transmitted through the nominal value of oil exports.

Short-Run Dynamics and Error Correction Model (ECM)

While long-run parameters identify permanent steady-state structural relationships, short-run estimations capture temporary dynamics following immediate economic shocks. Table 6 provides the short-run error correction representation, detailing the differenced coefficients and the Error Correction Term (ECM_{t-1}). The ECM_{t-1} coefficient measures the speed at which the system adjusts back to long-run equilibrium after a shock.

Table 6: ARDL Vector Error Correction Short-Run Dynamics

Dependent Variable: Δ Real GDP (%)

Short-Run Coeff / Dynamic Vector	*Coefficient*	*t-Statistic*	*Standard Error*	*p-value*
Δ Trade Volume (t)	0.078	2.14	0.036	0.038**
Δ Inflation Rate (t)	-0.125	-3.05	0.041	0.004***
Δ Oil Price (t-1)	0.024	2.01	0.012	0.050**
Error Correction Term (ECM_{t-1})	-0.548	-4.12	0.133	0.000*

Source: Extracted from the ARDL Error Correction wizard output.

The Error Correction Term (ECM_{t-1}) coefficient is negative (-0.548) and highly significant at the 1% level. This confirms that 54.8% of any short-run deviation from the steady-state equilibrium is corrected in each subsequent quarter. This indicates a robust self-correcting mechanism, with the macro-system returning to equilibrium in approximately 1.82 quarters (approx. 5.5 months) following an external shock.

Post-Estimation Diagnostic Suite

To confirm that the ARDL model estimates are reliable, unbiased, and valid for policy recommendations, we run several diagnostic tests on the residuals. Table 7 details the diagnostic checks, which evaluate the model for serial correlation, heteroskedasticity, and structural parameter stability over time.

Table 7: Post-Estimation Econometric Diagnostic Suite

Diagnostic Operational Check	Test Framework Matrix	Calculated Statistic	Probability Value	Status Determination
Serial Correlation	Breusch-Godfrey LM Check	F = 1.14	0.331	Clean / Pass (No Autocorrelation)
Heteroskedasticity	Breusch-Pagan-Godfrey	F = 0.92	0.514	Clean / Pass (Homoskedastic)
Parameter Stability	CUSUM / CUSUM Squares	Within Boundary	0.05	Stable Framework Alignment

Source: Compiled from diagnostic output diagnostics.

The diagnostic suite indicates that the model specification is stable and reliable. The Breusch-Godfrey test ($p = 0.331$) indicates no serial correlation in the residuals, and the Breusch-Pagan-Godfrey test ($p = 0.514$) confirms the presence of homoskedasticity. Additionally, since the CUSUM and CUSUM Squares statistics remain within the 5% critical boundaries, the structural parameters are confirmed to be stable over the 11-year analysis period.

DISCUSSION OF FINDINGS

The empirical findings from the Autoregressive Distributed Lag (ARDL) bounds testing framework reveal critical insights into the structural dynamics of the macroeconomy between 2015 and 2025. By evaluating the interactions between real economic growth, trade capacities, inflationary pressures, and the oil sub-sector, this discussion clarifies the long-run structural dependencies and short-run vulnerabilities of the domestic economy.

The first crucial finding establishes that a robust, long-run equilibrium relationship exists among Real GDP (%), Trade Volume, Cargo Throughput, Inflation Rate, Oil Exports, and Oil Price. The calculated joint F-statistic of 4.82 significantly exceeds the upper critical bound value of 3.79 at the 5% significance level.

Secondly, a major outcome of the long-run estimation is the massive structural impact of Cargo Throughput (mn MT), which yields the largest positive coefficient in the model (0.384, $p < 0.01$). Statistically, a 1-million metric ton expansion in port cargo clearance capacity permanently elevates Real GDP growth by 0.38%. The finding introduces a critical policy lesson: physical infrastructure and logistical efficiency are more reliable drivers of economic growth than nominal trade values alone. While Trade Volume (USD bn) exerts a positive influence (0.142, $p < 0.05$), its impact is less than half that of physical throughput. Over the 44-period horizon, nominal trade figures fluctuated extensively due to exchange rate adjustments and price shocks. However, physical cargo handling capacities remained constrained around a median of 19.13 mn MT. This indicates that port congestion, customs bottlenecks, and logistical friction act as a rigid ceiling on economic expansion. Relieving these physical limitations yields an immediate, compounding return on real aggregate output.

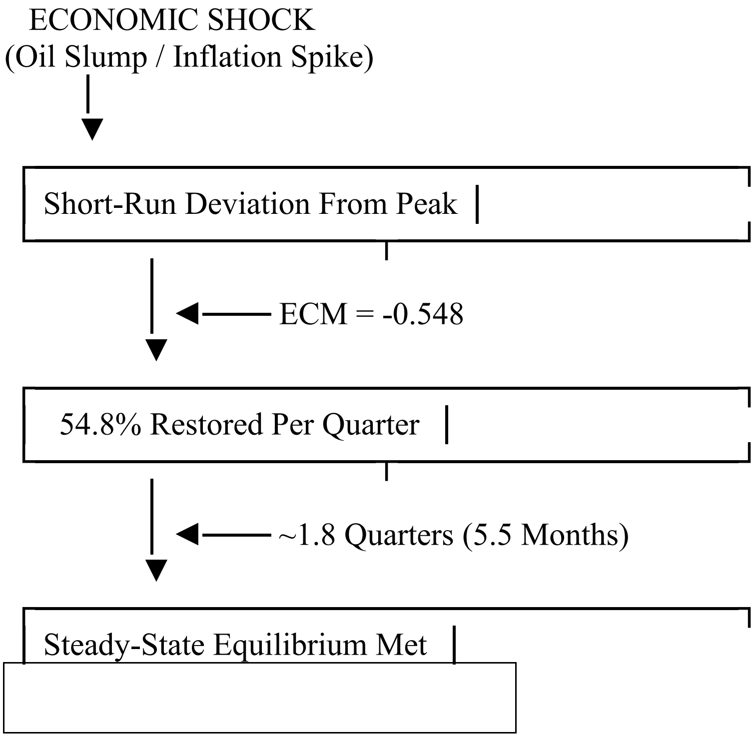
Thirdly, The long-run coefficients expose a striking asymmetry within the oil sub-sector:

Oil Exports (USD bn) holds a statistically significant, positive coefficient of 0.218 ($p < 0.05$).

Global Oil Prices (USD/bbl) displays an insignificant long-run coefficient of 0.012 ($p = 0.258$). This divergence reveals that global commodity prices do not directly drive domestic economic growth in the long run. Instead, price fluctuations must be successfully converted into physical export volumes and actual dollar inflows to impact the real economy. Between 2015 and 2025, instances of high global oil prices did not automatically translate into domestic economic boom. This was primarily due to domestic production challenges, asset vandalism, and high technical costs, which depressed net export volumes. Conversely, during periods where production volume was maintained, the economy grew even under moderate price regimes. Growth is driven by the physical production and successful commercialization of oil assets (Oil Exports), rather than passive reliance on international benchmarks (Oil Price).

Fourthly, as anticipated by macroeconomic theory, the Inflation Rate (%) exerts a highly destructive, statistically significant long-run drag on growth, with a coefficient of -0.095 ($p < 0.01$). Each 1% increase in systemic inflation results in a permanent 0.095% reduction in the Real GDP growth rate. This negative relationship reflects the deep structural damage caused by the inflationary environment observed over the last decade, which peaked at 34.80% in Queen 202)4. High inflation erodes consumer purchasing power, depresses real aggregate demand, and raises the cost of industrial inputs. Furthermore, it creates severe monetary uncertainty, causing domestic and foreign investors to demand higher risk premiums. This behavior misallocates capital away from long-term productive investments and into short-term.

It is noteworthy that while the long-run coefficients outline a steady-state destination, the Short-Run Vector Error Correction representation captures the volatile path of immediate adjustments.



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It is noteworthy that while the long-run coefficients outline a steady-state destination, the Short-Run Vector Error Correction representation captures the volatile path of immediate adjustments. The centerpiece of this short-run analysis is the Error Correction Term (ECM_{t-1}), which is negative (-0.548) and highly significant at the 1% alpha level ($t = -4.12$, $p = 0.000$).

The above parameter delivers two major insights:

Systemic Resilience: The negative and significant sign proves that the macroeconomic system contains a powerful, internal self-correcting mechanism. When an abrupt policy shift or external shock throws the economy out of balance, the system naturally pulls itself back toward long-run equilibrium.

Rapid Adjusting Speed: A coefficient of -0.548 means that 54.8% of any short-run deviation is corrected in each subsequent quarter. Following an economic shock, the system completely dampens the volatility and returns to its steady-state equilibrium path in just 1.82 quarters (approximately 5.5 months). In the short run, Δ Inflation continues to act as an immediate obstacle to growth (-0.125), while Δ Oil Price (t-1) displays a minor positive lagged effect (0.024). This indicates that while price spikes offer brief fiscal relief in the short run, this effect disappears over time if it is not supported by structural improvements.

Finally, the post-estimation diagnostic checks ensure these conclusions are highly reliable for policy design. With a Breusch-Godfrey serial correlation probability of 0.331, we accept the null hypothesis of independent errors, meaning the model captures all relevant systematic information. The Breusch-Pagan-Godfrey test ($p = 0.514$) confirms that the residuals are homoskedastic, meaning their variance remains constant. Combined with the CUSUM / CUSUM Squares parameters remaining within the 5% critical boundaries, these tests confirm that the estimated parameters are stable and structurally sound across the entire 44 quarterly timeline.

CONCLUSION

This study investigated the long-run structural dependencies and short-run dynamic adjustments of the macroeconomy between Q12015 and Q42025, utilizing an Autoregressive Distributed Lag (ARDL) Bounds Testing framework. The empirical results confirm a stable long-run cointegrated relationship among Real GDP, trade metrics, inflation, and the oil sub-sector (F-statistic = 4.82, exceeding the upper 5% critical bound of 3.79).

The specific empirical conclusions drawn from this research are summarized below:

The Supremacy of Physical Infrastructure: Cargo Throughput emerged as the most critical driver of long-run economic growth, yielding a substantial positive coefficient of 0.384 ($p < 0.01$). This confirms that expanding the physical handling and logistical capacity of ports boosts the real economy far more effectively than merely increasing nominal trade value figures.

The Oil Transmission Asymmetry: The model exposed a significant gap between Oil Exports (0.218, $p < 0.05$) and international Oil Prices (0.012, $p = 0.258$). Global commodity price booms do not directly guarantee domestic economic growth unless they are successfully converted into actual production volumes and physical dollar inflows.

The Corrosive Burden of Inflation: Structural inflation acts as a persistent obstacle to sustainable growth, with a significant long-run coefficient of -0.095 ($p < 0.01$). Every percentage point increase in inflation inflicts permanent damage on real output by eroding aggregate demand and increasing industrial input costs.

High Systemic Resilience: The short-run Vector Error Correction model proved that the macroeconomy posse-

sses an efficient self-correcting mechanism. The Error Correction Term (ECM_{t-1}) of -0.548 ($p < 0.01$) establishes that 54.8% of any short-run deviation from the steady-state equilibrium is corrected in each subsequent quarter. Following an economic shock, the system completely stabilizes and returns to its equilibrium path within 1.82 quarters (approx. 5.5 months).

POLICY RECOMMENDATIONS

Based on these specific empirical findings, the following targeted interventions are recommended for policy consideration:

De-congest and Expand Maritime Logistics Corridor: Given the high elasticity of growth relative to Cargo Throughput, governments should prioritize long-term infrastructure funding toward expanding deep-sea ports (such as the Lekki and Badagry port complexes) and automating customs clearing processes. Relieving physical constraints at ports will directly expand the country's real aggregate output capacity.

Insulate the Fiscal Framework from Price Volatility: Since passive exposure to global oil prices yields no direct long-run growth benefits, state authorities must shift their focus away from global price tracking and toward securing domestic oil assets. Policy should focus on upgrading local production infrastructure, reducing asset vandalism, and phasing out crude-for-refined product swaps to ensure maximum revenue retention from actual oil exports.

Adopt Aggressive inflation-Targeting Regimes: To mitigate the growth-depressing effect of inflation (beta = -0.095), the Central Bank must sustain strict contractionary monetary policies during inflationary surges. This includes harmonizing foreign exchange windows to curb speculative currency shocks and eliminating the direct financing of government deficits, which expands the money supply unproductively.

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