Exchange Rate Dynamics and Port Operations in Nigeria

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Abstract
Efficient port operations are essential for boosting Nigeria's economic growth, as they directly affect sectors like manufacturing, oil and gas, and agriculture. Evaluating the impact of exchange rate fluctuations on cargo throughput can provide insights into improving economic outcomes; this therefore has necessitated this study. The study examines the relationship between exchange rate dynamics and port operations in Nigeria. Secondary data collection method was used and Ex - post-facto research design was adopted to achieve the objectives of the study. The study draws its data from the annual reports of the Nigerian Port Authority and World Bank Statistical Bulletin with focus on information from 1997 – 2023 for 27 years period. The ARDL Bound Test approach was adopted in estimating the relationship between the dependent and independent variables. The study findings indicate that exchange rate dynamics are not primary drivers of port operations in Nigeria. The study findings further show that there is no positive significant relationship between exchange rate and cargo throughput in Nigeria; there is positive and statistically insignificant relationship between interest rate and cargo throughput in Nigeria and inflation rate have negative and insignificant relationship with cargo throughput in Nigeria. Based on the findings, the study recommends that port authorities should enhance port infrastructure, automation, and efficiency to improve cargo handling capacity and throughput, regardless of exchange rate dynamics. Finally, the government should focus on maintaining a stable macroeconomic environment, managing inflation through sound fiscal and monetary policies, and ensuring that inflation does not spiral to levels that could hurt port-related businesses.

Keywords: Exchange Rate, Interest Rate, Inflation Rate, Port Operations, Cargo Throughput

1.0 Introduction

Exchange rate strategically lies at the centre of global financial system and sets the terms on which countries trade each other's goods and services. Exchange rate is one of the most important key microeconomic variables in the context of general economic policy making and reform programmes. It is an essential element in the determination of the pace at which a country's economic activities will grow (Próchniak, & Witkowski, 2013). Thus, discussion on methods of management of exchange rate has been a recurring topic in international monetary economics. According to Chou (2020), the debate on exchange rate management transcended the collapse of the gold standard in the 1930s to the emergence of Bretton Wood System of adjustable peg from the 1940s through other various exchange rates. The debate moves along the two notable poles of fixation and flexibility. With the move from fixed to flexible exchange in Europe in 1973, there was increasing concern about effects of exchange rate variability on trade (Dornbusch, (2019). Flexible exchange rate which followed the collapse of the Breton Wood System is of concern to economists and policy makers (Williamson, 2021). Nigeria's economy is heavily reliant on international trade, with ports serving as critical gateways for the import and export of goods. The country's strategic location along the West African coast positions its ports as essential hubs for both domestic and regional trade. However, the efficiency and effectiveness of these ports are closely tied to the nation's economic environment, particularly the behaviour of exchange rates (Psaraftis, & Kontovas, 2013).

The exchange rate of the Nigerian Naira has been subject to significant fluctuations over the years. These fluctuations are often driven by a combination of domestic and international factors, including changes in global oil prices (given Nigeria's status as a major oil exporter), shifts in foreign capital flows, and domestic economic policies. According to Pangeran, (2023), the exchange rate is a barometer of economic stability, influencing the cost of imports, the competitiveness of exports, and the overall balance of trade. Nigeria's exchange rate regime has evolved over time, transitioning from a fixed exchange rate system to a more flexible and market-determined approach (Olufemi, Mary & Ndako, (2023). Despite this, the Naira has faced considerable pressure, leading to episodes of devaluation and the emergence of multiple exchange rate windows. These dynamics have profound implications for various sectors of the economy, including port operations.

The Central Bank of Nigeria (CBN) plays a pivotal role in managing the country's monetary policy, with interest rates serving as a key tool. Interest rate adjustments influence capital flows, with higher rates attracting foreign investments and bolstering the Naira, while lower rates may lead to capital outflows and currency depreciation (Opuala-Charles, & Orji 2023). These movements in exchange rates directly impact the cost of imports and exports processed through Nigerian ports. Nigeria has struggled with persistent inflation, driven by factors such as supply chain constraints, high production costs, and currency depreciation. Inflation erodes the value of the Naira, leading to higher costs for imported goods and services, including those essential for port operations (Martins, Eze, & Okeyika, (2024). High inflation rates can also deter foreign investment, further exacerbating exchange rate volatility.

Foreign Direct Investment (FDI) is a critical source of capital for infrastructure development and economic growth in Nigeria. The stability and predictability of exchange rates are essential in attracting FDI, particularly in sectors like port operations that require substantial long-term investment (Kawai, & Naknoi, (2017). Volatile exchange rates can increase investment risks, discouraging foreign investors and impacting the modernization and expansion of port facilities. Nigeria's ports, including major ones like Lagos, Port Harcourt, and Calabar, are vital to the country's economy. These ports handle a significant volume of the nation's imports and exports, making them critical nodes in global trade networks (Verschuur, Koks, & Hall (2022). However, the efficiency of port operations is often hampered by infrastructure challenges, bureaucratic inefficiencies, and security concerns. According to Akinade, (2020), exchange rate dynamics add another layer of complexity, influencing the cost structure of port operations and the competitiveness of Nigerian ports. Given the importance of ports in facilitating trade and economic growth, understanding the interplay between exchange rate dynamics and port operations is crucial. This study aims to explore how fluctuations in exchange rate, interest rate and inflation rate which are key dimensions of exchange rate dynamics affect the operational efficiency and competitiveness of Nigerian ports.

1.1 Statement of the Problem

Nigeria's economy, which is highly dependent on foreign trade, is closely linked to the port industry's performance. According to Verschuur, Koks, and Hall (2022), ports are vital entry points for the importing of machinery, raw materials, and necessities as well as the export of commodities like oil and agricultural products. However, changes in the Nigerian Naira's currency rate have a big impact on the ports' competitiveness and operating efficiency. These swings, which are caused by important economic variables including inflation, interest rates, and foreign direct investment (FDI), pose difficult problems for port operations (Saidi, Mani, Mefteh, Shahbaz, & Akhtar, 2020). The currency rate's volatility, which has become a recurring aspect of the Nigerian economy, is the main issue. The price of imported goods and the capital expenditures needed to establish port infrastructure are just two examples of how exchange rate volatility affects the cost structure of port operations. Effective planning is challenging for port operators, investors, and policymakers due to the unpredictability of exchange rate fluctuations, which can result in inefficiencies and possible losses (White, 2012).

Nigerian interest rates fluctuate frequently as a result of monetary policy initiatives meant to stabilise the economy, reduce inflation, or draw in foreign investment. Exchange rates may experience unforeseen repercussions from these adjustments, though. For instance, a short-term increase in interest rates may draw in foreign investment and cause the value of the Naira to rise, but it may also make borrowing more expensive for companies, including those engaged in port operations (Okere, 2021). On the other hand, a drop in interest rates may cause the Naira to weaken, raising the price of imports and decreasing local companies' purchasing power. The issue is that these interest rate-driven exchange currency swings can make Nigerian ports' operating environments unstable, making it challenging for port operators and authorities to make precise cost and revenue projections (Opuala-Charles, & Orji 2023). Long-term investments in the port industry may be discouraged by this instability, which would further impede its growth.

A number of variables, including supply chain disruptions, a strong reliance on imports, and currency depreciation, have contributed to Nigeria's ongoing inflation. The Naira loses value due to inflation, which raises the cost of imports and lowers the actual income of households and companies. High inflation can lower operating efficiency and profitability for port operations by driving up the cost of imported gasoline, equipment, and other necessary inputs (Notteboom, Pallis, & Rodrigue, 2021). The problem is that a cycle of increasing expenses and diminished competitiveness for Nigerian ports may result from inflation-driven currency rate depreciation. Nigeria's port industry may lose business as traders and shippers look for other routes or ports as the cost of importing goods through Nigerian ports rises. This does not only affects the revenue of port authorities but also has broader implications for the national economy, given the central role of ports in facilitating trade (Rodrigue, & Notteboom, 2020).

The growth of Nigeria's port infrastructure depends heavily on foreign direct investment (FBI), which supplies the funds required for expansion, modernisation, and technical advancements. Foreign investors, however, are at serious risk from exchange rate volatility since they can worry about how currency changes will affect their profits (Ghosh, Ostry, & Tsangarides, 2011). Unpredictable returns can result from volatile exchange rates, which can make investment planning more difficult and make Nigeria less appealing as a place to invest. The issue here is that attempts to draw and keep foreign direct investment (FDI) in the port industry may be hampered by exchange rate volatility, which is influenced by variables like inflation and interest rates (Siddiqui, 2015).. This, in turn, can have negative consequences for the broader economy, as inefficient ports can hinder trade; reduce foreign exchange earnings, and slow economic growth (Morrison, 2019).

Despite the critical importance of exchange rate dynamics for port operations, there is a limited understanding of how specific factors like interest rates, inflation, and FDI interact to influence the exchange rate and, subsequently, port efficiency in Nigeria. The lack of comprehensive research on this topic creates a knowledge gap that hinders effective policymaking and strategic planning. This research aims to fill this gap by examining the relationships between these key economic variables and their impact on port operations.

1.2 Objectives of the Study

The aim of this study is to determine the relationship between exchange rate dynamics and port operations in Nigeria. The study specific objectives are to:

i. Ascertain the relationship between exchange rate and cargo throughput in Nigeria.
ii. Determine the relationship between interest rate and cargo throughput in Nigeria.
iii. Investigate the relationship between inflation rate and cargo throughput in Nigeria.

2.0 Conceptual Review

1. Exchange Rate Dynamics

Exchange rate is the value of one currency in relation to another currency. It determines how much of one currency can be exchanged for a unit of another currency. Exchange rate volatility is a natural consequence of the floating exchange system common to most major economies of

the world (Galadima, 2015). Exchange rate volatility in Nigeria demonstrates how erratic the country's currency has become (Ukemenam, 2016). Oladipo (2016) states that exchange rates can be understood as the amount of domestic currency that is needed to purchase one unit of foreign currency (Oladipo, 2016). Chowdhury (2004) states that the exchange rate has been found to be useful in forecasting currency crises, which have recently affected emerging market economies by increasing or decreasing the RGDP. A country's exchange rate is significant because it affects all macroeconomic variables, which explains why the private sector and monetary authorities seek to stabilise these variables (Ajakaiye, 2012). Exchange rate fluctuation is the basis for all global economic activities, demonstrating that exchange rate operation is a major factor that decides many countries' economic policies (Todaro, 2004).

Aliyu (2011) maintained that exchange rate appreciation will result in increased imports and declined export while depreciation would expand export and discourage import. Also, depreciation of exchange rate tends to cause a shift from foreign goods to domestic goods. Hence, it leads to diversion of wealth from importing countries to countries exporting through a shift in terms of trade, and this tends to have impact on the exporting and importing countries' economic growth. Exchange rate variations in Nigeria have led to a unstable environment which can be ascribed to the reason why the country finds it difficult to increase its economic performance. As such, despite the vast opportunities in agriculture, industry, oil and gas, commerce and infrastructure, Nigeria has achieved a very minimal growth as a result of depreciating exchange rate which affects the standard of living of its citizens. To address this problem government have adopted a viable strategy and policy to solve the problem of weak exchange rate while boosting its economic growth (Rodrik, 2018). In response to the 2007 currency crisis, the Nigerian Autonomous Foreign Exchange Rate Fixing Methodology (NAFEX) was established in 2007. However, the Nigerian currency rate and economic growth have performed poorly in spite of these macroeconomic policy measures. The main concerns here are why the currency rate fluctuates and how this alteration impacts economic growth, notwithstanding the government's efforts to stabilise it.

Interest Rate

An interest rate is the percentage charged by a lender to a borrower for the use of money or the return earned on investments over a period of time. It is typically expressed as an annual percentage of the principal amount. According to Uchendu, (1993), interest can be defined as the return or yield on equity or opportunity cost of deferring current consumption into the future. This definition clearly shows that interest is a concept which can mean different things depending from the perspective it is viewed. Interest rate can therefore be seen as a nebulous concept, a position affirmed by the availability of different types of this rate. Some of which are; savings rate, discount rate, lending rate and Treasury bill rate. Apart from this, interest rate can also be categorized as nominal or real. This category claimed to Irvin Fisher aims to account the moderating influence of inflation on interest rate. Nominal interest rate is the observed rate of interest incorporating monetary effects while real interest rate is arrived at by considering the implications of inflation on nominal interest rate (Uchendu, 1993; Essia, 2005). Interest rates' balancing effect on supply and demand in the financial sector is what makes them so important. This was corroborated by Colander (2001) and Ojo (1993), who stated that

interest rates on financial assets and liabilities have a significant impact on people's propensity to assume financial commitments as well as how they allocate their savings.

The Keynesian investment theory, as well as the saving and investment hypothesis of Mackinnon (1973) and Shaw (1973), guides the determination for deregulation. According to Keynesian theory, a low interest rate as a cost of administration hinders the growth of savings and, consequently, the need for investments. They contend that a rise in the real interest rate will have a significant positive impact on savings that can be used for investments because it will incentivise individuals with excess liquidity to save. As a result, banks will have more money to lend to investors for investment purposes, increasing the amount of profitable investment. According to classical economics, the savings rate of interest determines the amount of saves (Olusoji, 2003). According to this theory, a rise in interest rates will result in more savings and a favourable connection. The Nigerian authorities' decision to switch from administratively regulated interest rates to market-determined ones must have been influenced by this viewpoint.

Inflation Rate

Inflation refers to the persistent and the continuous rise in the general level of prices of goods and services in an economy. It is no gainsaying the fact that different economies in different parts of the world experience inflation. Maybe the differences lie in the timing, causes, duration and in their prevailing economic conditions. Suffice to say then that, be it developed, developing or underdeveloped; economies of countries of the world does witness rise in price. For some economies it could be mere fluctuations, while for some others, it is consistent and continuous rise in price. According to Lipsey and Chrystal (1995), inflation is characterised as a widespread price increase that lasts for a long time in an economy; in other words, a continuous increase in the cost of goods and services that reduces the purchasing power of the currency. Only a small number of people appear to be aware of the causes, mechanisms, and actual effects of inflation on national economic growth, despite the fact that inflation is a common phrase in many market-oriented economies and that there is a wealth of empirical research on the topic.

Hossain and Islam (2012) contend that while excessive inflation is detrimental to an economy due to its negative impact on economic performance, zero inflation is equally detrimental because it will ultimately cause the economy to stagnate, as mild inflation is necessary for economic growth. Since inflation is by no means a new issue or phenomenon, its control has become the unquestioned motto of economic policymakers worldwide over the years. The problem is not limited to national borders or emerging market economies of the world; it is also a general problem in developed market economies. Similar to this, Fatukasi (2012) noted that high inflation rates frequently result in significant economic distortions like a balance of payments deficit, naira devaluation, and a decline in working-class purchasing power, which prompts frequent wage agitations by workers' unions.

Port Operations

Port operations refer to all the activities involved in managing and handling ships, cargo, and passengers at a port. These operations ensure the efficient movement of goods and vessels while maintaining safety, security, and regulatory compliance. Since the colonial era, port operations in Nigeria have seen tremendous change. In order to facilitate the export of agricultural products, crude oil, and other natural resources, major ports including Lagos, Port Harcourt, Warri, and Calabar were developed in the early 20th century. The government owned and ran the nation's ports until 1954, when the Nigerian Ports Authority (NPA) was created to oversee them (Nduka & Ifepe, 2021). In order to handle growing trade volumes, port facilities were significantly expanded in the years after Nigeria gained its independence. Nigeria's ports experienced severe inefficiencies in the late 1990s and early 2000s as a result of out-dated infrastructure, bad management, and corruption. This led to the port concessioning program of 2006, which transferred the management of port operations to private terminal operators under the supervision of the NPA. The reform's objectives were to modernise port infrastructure, increase efficiency, and draw in private investment (Mthembu & Chasomeris, 2023). .

Nigeria's ports, which handle almost 80% of the country's imports and exports, are vital to its economy. The Lagos Ports Complex (Apapa and Tin Can Island), Port Harcourt Port, Onne Port, Warri Port, and Calabar Port are some of the main ports. These ports are ideally situated to meet the needs of trade in various parts of the nation. However, the majority of Nigeria's marine trade is handled by the ports in Lagos, specifically Apapa and Tin Can Island, which causes traffic jams and operational bottlenecks (Oluwakoya, & Ogundipe, 2022). Inadequate infrastructure is one of the biggest issues Nigerian ports face. Long turnaround times, high operating expenses, and cargo delays are only a few of the inefficiencies caused by the ageing infrastructure and inadequate maintenance of many Nigerian ports. Traffic congestion is a well-known problem on the roads leading to ports, particularly in Lagos, which makes delays even worse and raises operating expenses. By international standards, Nigerian ports have been slow to adopt new technologies. Notwithstanding the NPA's efforts to implement electronic systems such as the Nigerian Integrated Customs Information System (NICIS) and the Electronic Cargo Tracking Note (ECTN), the potential efficiency improvements have been constrained by the absence of complete automation and integration throughout port operations. The implementation of the Single Window system, which aims to streamline and harmonize port processes, has also faced delays (Ogunlesi, 2023).

According to Odubajo, and Quadri, (2023), the regulatory framework governing port operations in Nigeria is complex and involves multiple agencies, including the Nigerian Ports Authority (NPA), the Nigerian Maritime Administration and Safety Agency (NIMASA), the Nigeria Customs Service (NCS), and the Nigerian Shippers' Council (NSC). These entities' overlapping responsibilities can occasionally cause inefficiencies in port operations and bureaucratic hold-ups. A major regulatory change intended to increase efficiency was the port concessioning program of 2006, which gave operational duties to private terminal operators (Iwuoha, Okafor, & Ifeadike, 2022). This scheme has, however, had varying degrees of success; some terminals have seen notable operational gains, while others have suffered as a result of corruption, poor management, and a lack of funding. The cost of port services, cargo

dwell time and vessel turnaround time are some indicators of operational effectiveness in Nigerian ports.

Measures of Port Operations

The measures of port operations encompass various metrics and indicators that assess the efficiency, productivity, and overall performance of a port. These measures are crucial for port authorities, shipping companies, and other stakeholders to evaluate and improve port operations. It includes turnaround time, cargo throughput, container throughput, vessel waiting time, customer satisfaction, damage and loss rates etc. This study used cargo throughput to measure port operations.

Cargo Throughput

Because it quantifies the amount of cargo a port handles in a given time frame, cargo throughput is a crucial indicator in the domains of port operations, logistics, and supply chain management. The entire amount of cargo (measured in metric tonnes or TEUs, or Twenty-foot Equivalent Units) that moves through a port or terminal in a given amount of time is known as the cargo throughput. This measure is essential for evaluating ports' capacity and efficiency as well as its financial influence on regional and national economies. One important measure of port performance is cargo throughput. According to Ndalu and Umennaihe (2024), cargo throughput is the total volume or quantity of goods and merchandise that passes through a specific transportation node, such as a port, airport, railway station, or other logistics hubs, within a given period.

While low throughput could be a symptom of inefficiencies, capacity issues, or waning demand, high throughput typically denotes a port that is operating well and that has high demand for its services (Fahim, Rezaei, Montreuil, & Tavasszy, 2022). Key elements of the connection between cargo throughput and port performance include competitiveness, economic development, capacity utilisation, and income creation. The operational difficulties and economic importance of Nigeria's port system are revealed by the analysis of cargo throughput at its ports (Edih, Faghawari, & Agboro, 2023). Because they make imports and exports easier, Nigeria's ports—including the Lagos Ports Complex, Port Harcourt, Onne, Warri, and Calabar—are essential to the country's economy.

Seifegha, Ndalu and Okene (2023) assert that the entire volume of cargo that a port handles over a specific time period is known as cargo throughput, often referred to as port throughput, and it is a crucial indicator of port performance. It can be divided into distinct types of cargo, such as containerized cargo, dry bulk cargo, and liquid bulk cargo (Grote, Mazurek, Gräbsch, Zeilinger, Le Floch, Wahrendorf, & Höfer, 2016). It is commonly measured in tonnes. Port throughput is important because it is a leading indicator of the economic activity of a port and its hinterland (Marlow and Casaca, 2003). Shipping firms and other port users also benefit from it since it aids in their operational planning and selection of the most effective ports.

11. Theoretical Framework

The study is anchored on the purchasing power parity propounded by Gustav Cassel in 1920s because it discusses how nominal exchange rate considers the buying power of one currency relative to another and that an exchange of purchasing power occurs between any two countries which are measured by the equivalent of one country's price level against another

The Purchasing Power Parity

This theory is credited to Gustav Cassel, a Swedish economist, who developed and popularized its empirical version in the 1920s. The nominal exchange rate considers the buying power of one currency relative to another and that an exchange of purchasing power occurs between any two countries which are measured by the equivalent of one country's price level against another (Cassel, 1916). The terms of free trade are that the nominal exchange rate between two countries should be equal to the ratio of the price levels in the two countries (Taylor, 1988). This approach assumes that real equilibrium exchange rates remain constant over time and therefore, the nominal exchange rate movement tends to offset relative price movements. The purchasing power parity defines two equilibrium rate systems. The first is the exchange rate that would exist in a totally floating exchange rate balance, or the short term equilibrium exchange rate. The second is the long-run equilibrium, which would produce balance of payments equilibrium over a period of time in a cooperative and cyclical manner. The problem of arbitrage and expectations in the commodity market are typically attributed to cyclical swings in the balance of payments, including those of the prevailing exchange rate by the relative purchasing power in a currency. Some economists have criticised purchasing power parity as flawed for the following reasons: Index number flaws: The PPP theory assumes that the exchange rate and the price level of the two legal tenders are directly related.

111 Empirical Reviews

The existing literatures on exchange rate dynamics and port operations have yielded different results and are presented in the table below:

Table1: Webo metric analysis of exchange rate dynamics and port operations in Nigeria

S/N	Authors/Year	Topic	Country	Variables	Methodology	Results
1	Anisiobi and Ezenwobi (2021)	Impact of exchange rate dynamics on economic growth in Nigeria	Nigeria	Real GDP, real exchange rate, consumer price index, interest rate, public debt, trade openness, gross	Ordinary least Square Techniques	The results of the analysis show that gross capital formation has no significant impact on economic growth. Also, trade openness has positive and significant impact

S/N	Authors/Year	Topic	Country	Variables	Methodology	Results
				capital formation.		on economic growth in Nigeria.
2	Osinubi (2019)	Effect of exchange rate volatility on economic growth in Nigeria	Nigeria	The variables used in the study are exchange rate, inflation rate, gross domestic product	Error correction model as well as OLS.	The study reveals a significant positive relationship between real GDP and exchange rate.
3	Mahonnye and Tenda (2019)	Exchange rate impact on output and inflation.	Zimbabwe	Inflation rate, currency devaluation, real output	Johansen co-integration regression test and Vector Error Correction Model (VECM).	The study found that in both the short run and long run, fluctuations in the real exchange rates are significant on real output growth and expansion..
4	Aidi, Saidu and Suleiman (2018)	The relationship between exchange rate volatility and manufacturing sector performance	Nigeria	Exchange rate, interest rate, trade openness, GDP	OLS multiple regression technique	Trade openness was observed to have a negative sign (though statistically insignificant) while, exchange rate and interest were also found to be strong and significant positive drivers of manufacturing sector performance in Nigeria.
5	Ogbonna (2017)	Effect of exchange rate volatility on economic growth in Nigeria	Nigeria	External reserves, domestic interest rate, RGDP growth rate and trade openness	Autoregressive conditional heteroscedasticity (GARCH) technique	The findings of the study indicated that exchange rate volatility has a negative but significant effect on Nigeria's economic growth..

S/N	Authors/Year	Topic	Country	Variables	Methodology	Results
6	Nsofor, Takon and Ugwuegbe (2017)	Exchange rate volatility in Nigeria and its effect on economic growth	Nigeria	Exchange Rate, Gross Domestic Product, Government Expenditure, External Reserve, and Foreign Direct Investment	GARCH (1,1) model and Generalized Method of Moments (0MM)	The result showed that volatility and FDI has negative and significant impact on the growth of the Nigerian economy. While, Government Expenditure and External Reserve has positive and significant impact on the growth of the Nigerian economy for the period under study.
7	Iyeli and Clement (2017)	Effect of exchange rate volatility on Economic Growth in Nigeria from 1970 to 2011	Nigeria	Exchange Rate (EXR), Balance of Payment (BOP) Oil Revenue (OREV), inflation rate and real GDP	Johansen Co-integration estimation techniques	The results show that OREV and EXR are positively related to GDP
8	Danladi and Uba (2016)	The study determined whether the volatility of exchange rate has implications for the economic performance of the countries in the West African	Nigeria & Ghana	Exchange rate and Economic growth	GARCH approach	The empirical results confirm that exchange rate volatility have a significant negative effect on economic growth

S/N	Authors/Year	Topic	Country	Variables	Methodology	Results
		Monetary Zone				
9	Ismaila (2016)	Exchange rate depreciation and Nigeria economic growth during the SAP and post SAP period: 1986–2012	Nigeria	Broad money supply, net export, total government expenditure, real output	Johansen co-integration test and error correction model analyses	The results show that broad money supply, net export and total government expenditure have significant impact on real output performance in the long run while exchange rate has direct and insignificant effect on Nigeria economic growth in both short and long run.
10	Martins and Muftau (2014)	Impact of exchange rate depreciation on balance of payment (BOP) in Nigeria over the period of 1961 – 2012.	Nigeria		Multivariate Vector Error Correction framework	A long-term equilibrium relationship was found between exchange rate and other variables employed.

3.0 Methodology

This study investigated exchange rate dynamics and port operations in Nigeria using exchange rate, interest rate and inflation rate as the dimension of exchange rate dynamics and cargo throughput as the measure of port operations. Ex - post-facto research design was adopted to achieve the objectives of the study. The population and the study sample size is the six (6) major Nigeria's ports which are critical to the country's economy, handling about 80% of the nation's imports and exports. They include: Lagos Ports Complex (Apapa and Tin Can Island); Port Harcourt Port; Onne Port; Warri Port; Calabar Port. These ports are strategically located to serve the trade needs of different regions of the country. Secondary data was used for the study which was obtained from the National Bureau of Statistics annual reports, CBN statistical bulletins, international financial statistics, World Bank and FIRS annual reports. The study focused on a time series data covering a period of 1997 to 2023 accounting years. The

descriptive statistics such as mean, standard deviation and standard error was used to organize, summarize and explain the features of the distribution of the collected data. While the inferential statistic of Ordinary Least Squares **(**OLS**)** regression was used to describe the relationship effect of independent quantitative variables on the dependent variables.

Model Specification

Model specification is the expression of relationship between variables into precise mathematical form. The study modifies the model developed by Seifegha, Ndalu & Okene, (2023), Idris & Suleiman (2019) and Inyiama (2013). In accordance with their models, the model for this study is as follows:

CTP FEXR, INT, INF)……. (1)

Where;
EXR = Exchange Rate
CTP = Cargo Throughput
INT = Interest Rate
INF = Inflation Rate
f = functional relationship

From equation (1), the formula is further stated in an econometric form as:

CTP =∝0+∝1 EXR +∝2 INT +∝3 INF + μ ……. ….(2)

Where:
∝0 = Intercept of relationship in the model
∝1 – ∝5 = Coefficients of each independent or explanatory variable
μ = Stochastic or Error term

4.0 Data Presentation and Analysis

Descriptive Statistics of all the Variables of the Study

Table 4.1: Descriptive Statistics

	CTP	EXR	INF	INT
Mean	57.73574	194.8624	15.36414	18.38414
Median	65.77551	134.0500	12.22000	17.55000
Maximum	99.01540	638.7000	72.84000	26.75000
Minimum	13.27305	81.20000	5.380000	11.48000
Std. Dev.	25.94150	130.6386	12.43676	3.463959
Skewness	-0.341037	1.739992	3.603642	0.836261
Kurtosis	1.813364	5.802986	17.03701	3.648343
Jarque-Bera	2.263605	24.12681	300.8540	3.888028
Probability	0.322451	0.000006	0.000000	0.143128
Sum	1674.336	5651.010	445.5600	533.1400

Sum Sq. Dev.	18842.92	477860.5	4330.847	335.9723
Observations	29	29	29	29

Source: *E-views 13.0 Statistical Output, 2024.*

Table 4.1: presents the descriptive statistics of four variables: CTP, EXR, INF and INT. Cargo throughput (CTP) has a negative skew (-0.34), meaning the data is slightly left-skewed, while exchange rate (EXR)**,** inflation rate (INF)**,** and interest rate **(**INT) are positively skewed, indicating the distributions have longer right tails. Interest rate (INF) has a very high kurtosis (17.04), indicating heavy tails, while others have more moderate or normal kurtosis values. The Jarque-Bera test indicates that inflation rate (INF) and exchange rate (EXR) have very low probabilities (close to 0), meaning their distributions significantly deviate from normality. For cargo throughput (CTP)**,** interest rate (INT)**,** the higher probabilities suggest closer alignment to a normal distribution.

Unit Root Tests

Unit root tests are statistical tests used to determine if a time series variable is non-stationary. The results of a unit root test are typically presented as a test statistic and a p-value. If the p-value is less than the chosen significance level (e.g., 5%), we reject the null hypothesis of a unit root and conclude that the variable is stationary. If the p-value is greater than the significance level, we fail to reject the null hypothesis and conclude that the variable is non-stationary.

Table 4.2: Unit Root Tests

Variable	**Test stat**	**Critical val. @ 5%**	**Probability**	**Integration**
CTP	-5.3297	-3.5875	0.0010	I(1)
EXR	-4.7321	-3.6450	0.0059	I(1)
INT	-5.5143	-3.5875	0.0007	I(1)
INF	-6.3720	-3.5875	0.0001	I(1)

Source: *E-views 13.0 Statistical Output, 2024*

Table 4.2 presents the results of Augmented Dickey-Fuller unit root tests for five variables (CTP, EXR, INT and INF). Unit root tests are typically used to check for stationarity in time series data, with non-stationary data being problematic for regression analysis as it can lead to spurious results. All variables (CTP, EXR, INT and INF) are I(1)**,** meaning they are non-stationary in their level form but become stationary after being differenced once. This is typical in macroeconomic time series, and further econometric modeling (e.g., cointegration or VAR models) should account for this order of integration.

Johansen Co-integration Test

The test shows the long run relationship between all the variables. The Null hypothesis (H0) states that there is no significant co-integrating relationship between the variables if the trace statistic and maximum Eigen value is greater than the 5% level of significance.

Table 4.3 - Cointegration Trace Test

Date: 08/31/24 Time: 14:19				
Sample (adjusted): 1997 2023				
Included observations: 27 after adjustments				
Trend assumption: Linear deterministic trend				
Series: CTP EXR INF INT				
Lags interval (in first differences): 1 to 1				
Unrestricted Cointegration Rank Test (Trace)				
Hypothesized		Trace	0.05	
No. of CE(s)	Eigenvalue	Statistic	Critical Value	Prob.**
None *	0.740221	88.89959	69.81889	0.0007
At most 1 *	0.719190	52.50561	47.85613	0.0172
At most 2	0.353971	18.21349	29.79707	0.5503
At most 3	0.201022	6.416885	15.49471	0.6462
At most 4	0.013153	0.357499	3.841465	0.5499
Trace test indicates 2 cointegrating eqn(s) at the 0.05 level				

Source: *E-views 13.0 Statistical Output, 2024*

The Cointegration Trace Test table 4.3 presents the results of a Johansen cointegration test, which examines the long-run equilibrium relationships among the variables (in this case, cargo throughput (CTP), exchange rate (EXR), inflation (INF) and interest rate (INT). The test evaluates whether these variables move together over time, indicating a long-term relationship despite short-term deviations. The trace statistic (88.89959) exceeds the critical value (69.81889), and the p-value is 0.0007, which is less than 0.05. This means we reject the null hypothesis of no cointegration and conclude that there is at least one cointegrating relationship among the variables.

4.2 Hypothesis Testing

Hypothesis stated in chapter one and modeled in chapter three are tested in this section. As stated earlier, based on the fact that all the variables were stationary at order 1(1); the Ordinary Least Squares regression model was used in estimating the variables. The decision criteria for all the hypothesis is indicated below:

Decision Criteria: **If,** *p*-value < 0.05, then the variable is significant **Reject H_0**
p-value > 0.05, then the variable is significant **Accept H_0**

Table 4.4: Regression Output Table

Dependent Variable: CTP				
Method: Least Squares				
Date: 08/31/24 Time: 14:37				
Sample (adjusted): 1998 2023				
Included observations: 26 after adjustments				
Variable	Coefficient	Std. Error	t-Statistic	Prob.
C	2.548170	0.501510	5.080992	0.0000

INT	0.007000	0.024148	0.289888	0.7747
INF	-0.026911	0.021820	-1.233305	0.2311
EXR	0.001080	0.001043	1.035698	0.3121
R-squared	0.803132	Mean dependent var		3.846538
Adjusted R-squared	0.765633	S.D. dependent var		0.717256
S.E. of regression	0.347234	Akaike info criterion		0.893404
Sum squared resid	2.531996	Schwarz criterion		1.135345
Log likelihood	-6.614248	Hannan-Quinn criter.		0.963074
F-statistic	21.41762	Durbin-Watson stat		1.510535
Prob(F-statistic)	0.000000			

Table 4.4 shows the results of the regression analysis with cargo throughput (CTP) as the dependent variable and Exchange Rate (EXR), Interest Rate (INT) and Inflation (INF) as the independent variables. The regression output examines the relationship between CTP and several lagged independent variables (EXR, INT and INF). Here's a concise interpretation:

Exchange rate (EXR) coefficient is (0.001080) which is positive. The positive coefficient suggests that an increase in exchange rates (depreciation of the domestic currency) may lead to an increase in cargo throughput. However, this effect is statistically insignificant (p-value > 0.05), implying no significant relationship between exchange rate changes and cargo throughput CTP in the model. Interest rate (INT) is positive and statistically insignificant relationship with CTP (coefficient = 0.007000, p = 0.7747). This suggests that the coefficient for interest rate is positive but very small and statistically insignificant (p-value > 0.05). This suggests that changes in interest rates have little to no significant effect on cargo throughput during the sample period. Inflation rate (INF) shows a negative and insignificant effect on CTP (coefficient = -0.026911, p = 0.2311). The negative coefficient suggests that inflation has a negative impact on cargo throughput, but this effect is not statistically significant (p-value > 0.05). This means the inflation rate is not a significant determinant of cargo throughput in this model.

The R-squared value is (0.803132) which indicates that approximately 80.31% of the variation in cargo throughput is explained by the independent variables (interest rate, inflation rate, and exchange rate) in the model. This is a relatively high level of explanatory power. Adjusted R-squared (0.765633), after adjusting for the number of variables in the model, the adjusted R-squared is 76.56%, which still indicates a good fit but accounts for any overestimation caused by adding more predictors. F-statistic: 21.41762 significant (p = 0.000000), the F-statistic tests whether the overall regression model is statistically significant. Since the p-value is 0.000, it indicates that the model as a whole is statistically significant, meaning that at least one of the predictors (interest rate, inflation, or exchange rate) significantly explains changes in cargo throughput. Durbin-Watson Statistic (1.510535), the Durbin-Watson statistic tests for autocorrelation in the residuals of the regression model. A value close to 2 indicates no autocorrelation. A value of 1.51 suggests there may be some positive autocorrelation, though it's not conclusive.

Post-Estimation Diagnostic Tests

Post-estimation diagnostic tests are statistical tests and procedures conducted after running a regression model to ensure the validity, reliability, and robustness of the estimated results. These tests help detect potential issues with the model that may violate the assumptions of classical linear regression, such as autocorrelation, heteroskedasticity, multicollinearity, normality of residuals, and model specification errors.

Serial Autocorrelation Test

The Breusch-Godfrey Serial Correlation LM Test is used to assess the presence of serial correlation in the residuals of a regression model.

Table 4.5: Serial Correlation LM test

Breusch-Godfrey Serial Correlation LM Test:			
Null hypothesis: No serial correlation at up to 2 lags			
F-statistic	0.842693	Prob. F(2,19)	0.4460
Obs*R-squared	2.118405	Prob. Chi-Square(2)	0.3467

Source: *E-views 13.0 Statistical Output, 2024*

Table 4.5 presents The Breusch-Godfrey Serial Correlation LM Test and shows the following results: The F-statistic is 0.842693 with a p-value (Prob. F(2,9)) of 0.4460, which is greater than the standard significance level (e.g., 0.05). This suggests there is no evidence of serial correlation in the residuals up to 2 lags. The Obs*R-squared value is 2.118405, with a p-value (Prob. Chi-Square (2)) of 0.4460, which also exceeds 0.05. This means there is no significant evidence of serial correlation in the residuals of the regression model up to 2 lags. In other words, the residuals are independent and not autocorrelated, which is a good indication that the model is well specified and the estimates are efficient.

Heteroskedasticity Test

The Heteroskedasticity Test is a statistical test used to check whether the assumption of homoskedasticity (constant variance of the residuals) in a regression model holds. Heteroskedasticity occurs when the variance of the errors (or residuals) in a regression model varies with the values of the independent variables. In other words, instead of having a constant spread, the residuals' variance changes, which can lead to inefficient estimates and unreliable hypothesis tests.

Table 4.6: Heteroskedasticity Result

Heteroskedasticity Test: Breusch-Pagan-Godfrey			
Null hypothesis: Homoskedasticity			
F-statistic	6.733753	Prob. F(4,21)	0.1012
Obs*R-squared	14.60958	Prob. Chi-Square(4)	0.2056
Scaled explained SS	5.079047	Prob. Chi-Square(4)	0.2793

Source: *E-views 13.0 Statistical Output, 2024*

Table 4.6 shows the heteroskedasticity test results using the Breusch-Pagan-Godfrey method indicate that the data does not suffer from heteroskedasticity. The F-statistic (6.733753) and its associated p-value (0.1012) are not statistically significant, meaning we fail to reject the null

hypothesis**.** This suggests that there is no significant evidence of heteroskedasticity in the model based on the F-statistic. The Obs*R-squared value (14.60958) with a p-value of 0.2056 and the Scaled explained SS (1.2526) with a p-value of (0.2793). This p-value also exceeds 0.05, indicating that the Scaled explained SS test provides no significant evidence of heteroskedasticity. The overall results imply that there is no significant evidence of heteroskedasticity in the residuals of the regression model. The residuals appear to have constant variance, implying that the model's estimates are efficient and that the assumptions of ordinary least square (OLS) regression are likely satisfied.

Unrestricted Cointegration Rank Test

Unrestricted Cointegration Rank Test (Maximum Eigenvalue) is used to determine the number of cointegrating relationships (long-term equilibrium relationships) among variables in a multivariate time series model. The test is based on the eigenvalues of the matrix that captures these relationships.

Table 4.7 - Cointegration (Maximum eigen) Test

Unrestricted Cointegration Rank Test (Maximum Eigenvalue)				
Hypothesized		Max-Eigen	0.05	
No. of CE(s)	Eigenvalue	Statistic	Critical Value	Prob.**
None *	0.740221	36.39398	33.87687	0.0245
At most 1 *	0.719190	34.29212	27.58434	0.0059
At most 2	0.353971	11.79660	21.13162	0.5679
At most 3	0.201022	6.059386	14.26460	0.6056
At most 4	0.013153	0.357499	3.841465	0.5499
Max-eigenvalue test indicates 2 cointegrating eqn(s) at the 0.05 level				

Source: *E-views 13.0 Statistical Output, 2024*

Table 4.7 presents the results of the Unrestricted Cointegration Rank Test (Maximum Eigenvalue)**,** which is used to determine the number of cointegrating relationships (long-term equilibrium relationships) among variables in a multivariate time series model. The eigenvalue is 0.740221, and the Max-Eigen Statistic is 36.39398, which exceeds the critical value of 33.87687. The p-value is 0.0245, which is less than 0.05. This suggests a null hypothesis of no cointegration, indicating that at least one cointegrating relationship exists.

5.0 Discussion of Findings

Exchange Rate and Cargo Throughput

The findings in table 4.5 relating to exchange rate and cargo throughput indicate that Exchange rate (EXR) coefficient is (0.001080) which is positive. The positive coefficient suggests that an increase in exchange rates (depreciation of the domestic currency) may lead to an increase in cargo throughput. However, this effect is statistically insignificant (p-value > 0.05), implying no significant relationship between exchange rate changes and cargo throughput CTP in the model. This finding is in line with the study of Anisiobi and Ezenwobi (2021) who studied the

impact of exchange rate dynamics on economic growth in Nigeria using annual time series data from 1987 to 2020. The empirical analysis showed that exchange rate, consumer price index, interest rate and public debt have negative and significant impact on economic growth. The results of the analysis show that gross capital formation has no significant impact on economic growth.

Interest Rate and Cargo Throughput

The findings in table 4.5 relating to interest rate and cargo throughput indicate that interest rate (INT) is positive and statistically insignificant relationship with CTP (coefficient = 0.007000, p = 0.7747). This suggests that the coefficient for interest rate is positive but very small and statistically insignificant (p-value > 0.05). This suggests that changes in interest rates have little or no significant effect on cargo throughput during the sample period. This finding is in line with the study of Ogbonna (2017) who investigated the effect of exchange rate volatility on economic growth in Nigeria. The findings of the study indicated that exchange rate volatility has a negative but significant effect on Nigeria's economic growth.

Inflation Rate and Cargo Throughput

The findings in table 4.5 relating to inflation rate and cargo throughput indicate that inflation rate (INF) shows a negative and insignificant effect on CTP (coefficient = -0.026911, p = 0.2311). The negative coefficient suggests that inflation has a negative impact on cargo throughput, but this effect is not statistically significant (p-value > 0.05). This means the inflation rate is not a significant determinant of cargo throughput in the model. This finding is in line with the study of Danladi and Uba (2016) who determined whether the volatility of exchange rate has implications for the economic performance of the countries in the West African Monetary Zone. Exchange rate variability was measured using the GARCH approach. The empirical results confirm that exchange rate volatility have a significant negative effect on economic growth.

6.0 Conclusion and Recommendations

6.1 Conclusion

The study empirically investigates exchange rate dynamics and port operations in Nigeria using panel data for the period of 27 years starting from 1997 to 2023. The conclusion of the findings indicate that there is no positive significant relationship between exchange rate and cargo throughput in Nigeria; there is positive and statistically insignificant relationship between interest rate and cargo throughput in Nigeria and there is negative and insignificant relationship between inflation rate and cargo throughput in Nigeria. The study concludes that key macroeconomic variables such as exchange rate**,** interest rate, and inflation rate do not have a significant direct influence on cargo throughput in Nigerian ports. This indicates that fluctuations in these variables may not be the primary drivers of port performance, suggesting that cargo throughput is influenced more by factors other than these macroeconomic elements.

Finally, Nigerian ports and cargo throughput are not significantly driven by the selected macroeconomic factors of exchange rate, interest rate, and inflation. Therefore, policymakers

and port authorities should focus on other determinants of port performance, such as: infrastructural development, operational efficiency and regulatory framework. Therefore, there is a need for a multifaceted approach to improving port operations, focusing on structural and operational enhancements rather than relying on macroeconomic adjustments to boost throughput.

6.2 Recommendations

Based on the findings, the study recommends as follows:

i. Port authorities should enhance port infrastructure, automation, and efficiency to improve cargo handling capacity and throughput, regardless of exchange rate dynamics.
ii. Policymakers should create a favourable investment climate, including stable interest rates and financial incentives, to attract local and foreign investors to develop port infrastructure and logistics facilities, which may drive up cargo throughput.
iii. The government should focus on maintaining a stable macroeconomic environment, managing inflation through sound fiscal and monetary policies, and ensuring that inflation does not spiral to levels that could hurt port-related businesses.

6.3 Areas for further Research

Researchers who are interested to carry out further research could explore other factors influencing port operations and provide deeper insights into the relationship between macroeconomic variables and port performance. Potential areas for further research include:

1. **Interest Rates and Cargo Throughput:** While the study may have focused on exchange rates, future research could examine how interest rates, credit availability, and trade financing impact port operations and cargo throughput.
2. **Inflation and Port Operations:** Research could explore how inflation affects port costs (e.g., labour, fuel, equipment), trade volumes, and overall port efficiency.

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