Arbitrage in Port Operation and Maritime Performance in Nigeria

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ABSTRACT: *The study examined arbitrage in port operation and maritime performance for period of (32) years spanning through 1990 to 2022. The independent variable employed in study (INFRSK), (EXCHR), (MNSP), and (TRB) meanwhile, the dependent variable is MRTGDP. Data were collected from CBN Statistical bulletin 2022. The study adopts the OLS methodology. Data set was described using descriptive statistics, correlation analysis and inferential analysis. The finding shows EXCHR and TRB have positive and significant relationship with MRTGDP while INFRSK and MNSP disclose negative relationship with MRTGDP. The study further recommends that stable macroeconomic policies should be adopted by port operators in order to maintain the macrocosmic risk variables, such as the rate of inflation, the value of the dollar, and the rate of Treasury bills, at a level that is helpful and consistent with marine performances. Also Despite the limited progress that has been made thus far, economic volatility has remained the biggest threat to the performance of the maritime industry. As a result, we offer strategic recommendations for driving port operating arbitrage.*

KEYWORDS: port operations, inflation rate, maritime performance, exchange rate, money supply, arbitrage.

INTRODUCTION

Nigeria's marine industry plays a significant role in the economy of the nation by facilitating trade abroad and creating jobs. The socioeconomic development of a nation is significantly influenced by trade, both domestic and international. However, international trade is one of the key forces

behind progress (Donatus 2018). A nation's economy is said to be growing when its trade balance improves and all scale economies and trade-offs work in its favor. It is conceivable to state that a country's economic growth increased its overseas trade because international trade itself has a considerable impact on economic growth. The aforementioned argument might be accepted when viewed from the perspective of a developing country like Nigeria, which is unable to manufacture the majority of the goods its population requires and must import them (Ndikom 2017).

She must also swap her raw materials, primarily crude oil, in order to obtain the foreign currency or exchange necessary to pay for the acquisition of capital equipment, material inputs, and technological know-how for her economic development. A port is a terminal building designed to accommodate all shipping requirements for a ship or sailing vessel to be given a berthing place, as well as to provide all necessary equipment and infrastructure for safe and efficient cargo handling activities, general maintenance, and the management of all shipping activities. Numerous elements exist in the Nigerian context that influence the performance of the marine sector and provide chances for arbitrage.

 The first is port operations, which are crucial for fostering trade and connecting Nigeria to international markets. Even so, arbitrage possibilities may arise as a result of port operations bottlenecks such hold-ups, traffic congestion, and laborious procedures (Obiageli, 2020). Second, pricing fluctuations; these occur frequently due to a variety of factors, such as different tariffs, taxes, and fees in different ports. Traders and shipping companies may strategically choose ports with lower expenses in order to reduce costs and boost earnings (Iris, 2021). Thirdly, there are regulatory variations; every port in Nigeria has and own set of rules, customs processes, and administrative needs. Arbitrage possibilities may result from these gaps because traders may take advantage of them to streamline operations and cut expenses (Onwuegbuchunam, 2019). Lastly, operational inefficiencies; port congestion, subpar infrastructure, and inadequate logistical systems may lead to delays and increased costs. Traders may select ports with more effective operations and quicker turnaround times in order to speed up their supply chains and boost profitability (Donatus et al., 2018). Although there are arbitrage opportunities, it's critical to solve the fundamental issues affecting port operations and Nigeria's maritime industry. The development of infrastructure, streamlining regulatory frameworks, strengthening security, and enhancing transparency and governance are important challenges. The Nigerian government has implemented a number of steps to improve performance and acknowledges the significance of the maritime sector. These activities comprise the creation of infrastructure development projects, port reform programs, and regulatory changes targeted at luring private sector investment (Onwuegbuchunam, 2019). In conclusion, there is a connection between port operation arbitrage and Nigeria's marine industry's performance. Profitable possibilities can be found through taking advantage of price discrepancies, regulatory inequities, and operational inefficiencies. However, to enhance the sector's performance and maximize its potential for sustainable growth, it is imperative to address underlying issues and put strategic plans into action.

Statement of the Problem

The expansion of Nigeria's economy is significantly influenced by the success of the maritime industry. The performance of the sector can be improved, resulting in greater trade volumes, employment possibilities, and general economic development. Efforts to optimize port operations, boost efficiency, and attract investments can do this. The issue at hand is arbitrage's presence in port operations and how it affects Nigeria's maritime industry as a whole. In the context of port operations, arbitrage, as previously stated, refers to the practice of profiting from pricing variations between different marketplaces. It involves taking advantage of variances in fees, taxes, and restrictions among various ports throughout the nation. There are a number of problems as a result of arbitrage in port operations.

First off, it has resulted in unfair competition amongst ports, as some ports offer lower prices or more lax restrictions to draw in more traffic, creating an uneven playing field (Bashir, 2018). Due to the concentration of cargo traffic in some ports and underutilization in others, ineffective resource allocation and decreased sector performance have ensued (Donatus, 2018). The marine industry's ability to generate money has also been significantly impacted by arbitrage in port operations.

When port fees and charges differ significantly, importers and exporters frequently prefer to transfer their cargo to ports with cheaper prices, which causes ports with higher fees to lose money. This has reduced the funding available for infrastructure development, maintenance, and port facility enhancement, which in turn hinders the growth and efficiency of the industry as a whole (Ndikom 2017). Additionally, arbitrage has encouraged port officials to manipulate fees and charges for their own gain, which has resulted in corruption and rent-seeking behavior. Effective governance and regulatory monitoring are severely hampered by this, which also compromises the sector's openness and integrity (Koren, 2021).

The present study addressed the topic of arbitrage in port operations and enhancing the performance of the maritime sector in Nigeria as a result of these conflicting issues as well as the paucity of literature. Introduction, literature review, methodology, findings/results of the study, conclusions, and suggestions make up the paper's format.

Hypothesis Development

$H0_1$: Inflation rate risk does not significantly affect Maritime contribution to GDP.

$H0_2$: Exchange rate volatility risk does not significantly affect Maritime contribution to GDP.

$H0_3$: Money supply rate of change does not significantly affect Maritime contribution to GDP.

$H0_4$: Treasury Bills rate does not significantly affect Maritime contribution to GDP.

REVIEW OF RELATED LITERATURE

Conceptual Review

Concept of Arbitrage
The process of exploiting price differences between markets or places in order to make money without taking on a lot of risk is known as arbitrage (Onwuegbuchunam, 2018). It entails taking advantage of inefficiencies, cracks, or disparities in port policies, tariffs, customs rules, or operational practices to obtain a competitive edge. Here are some instances of port operations arbitrage:

i.   **International Arbitrage**: In order to benefit from the price difference, this includes simultaneously purchasing and selling the identical security or asset on two different markets. For instance, a trader could purchase a security at a cheaper price in one port and sell that same security at a higher price in another port, making a profit without taking any risks (Koren, 2021).

ii. **Spatial Arbitrage**:Price differences between ports that are geographically apart are taken into account in this kind of arbitrage. Taking into account transportation capacity restrictions and other factors, traders could profit from these discrepancies by purchasing a good in one port and selling it at a higher price in another port (Benedicto, 2018).

iii. **Energy Arbitrage**:Energy arbitrage is the process of optimizing energy management and operations planning in the context of smart grid systems in ports in order to cut expenses. Utilizing load-shifting, renewable energy sources, and demand response systems can help with this (Abiodun, 2020). Since there are few prospects for arbitrage, thorough research and knowledge of market dynamics are necessary. Arbitrage actions may also be subject to regulatory risks and considerations.

Origin of Maritime Business in Nigeria
Nigeria is a coastal nation in the West and Central African sub-region, as described by Okerefe, (2018); Edih et al. (2022). It is blessed with a coastline of about 853 nautical miles and 3000 kilometers of navigable inland waterways, which extend from the Warri Estuaries in the south through the River Nigeria in the east and the River Benue in the north. The nation is bordered to the north by the Republic of Niger, to the west by the Republic of Benin, and to the east by the Republic of Cameroon. It is situated between Latitude 4°N and 14°N and Longitude 3°E and 15°E. To the northeast is the Republic of Chad, and via the Gulf of Guinea to the southernmost point is the Atlantic Ocean.

The Nation's Exclusive Economic zone (EEZ) occupied a total area of about 315,950 marine kilometers. Nigeria is in a position to take advantage of the opportunities presented by seaborne trade as a result of its coastline endowment. The British Chattered Companies, based in Southern

Nigeria, were the first maritime businesses to operate in Nigeria. Trading concerns were handed to John Holt, Lever Brothers, and the United African Company (UAC), which resulted in the establishment of ports in Southern Nigeria's Calabar, Sapele, Burutu, and Warri.

The Northern Nigerian Marine was formed in 1908 with its headquarters in Lokoja, and the Southern Nigerian Marine was established in 1906 by the British Colonial government with its headquarters in Lagos. But in 1914, both organizations combined to become Nigerian Marine, and Lagos Island's now-defunct Custom Wharf was born.

The Major Ports in Nigeria
In Nigeria's coastal regions, there are eight main ports and jetties. These include:

- Lagos Port Complex (LPC)
- Tincan Island Port
- Port Harcourt Old Port
- Federal Ocean Terminal
- Warri Port
- Koko Port
- Calabar Port
- Container Terminal

Theoretical Underpinning

Theories of Interest Rates:
The International Fisher Effect and the Fisher Effect Foreign exchange rates are computed using inflation rates in interest rate theories. According to the Fisher Effect, the nominal interest rate is calculated by adding the real interest rate and the inflation rate. Since both inflation and interest rates have an impact on exchange rates, real interest rates are employed to analyze these changes. Even when all other factors remain constant, changes in the real interest rate have a considerable impact on the country's exchange rate. To ascertain the impact of interest rate changes on FX price, the international Fisher Effect combines the PPP and FE. If a country's inflation rate rose relative to other countries, the value of its currency would decrease. The IFE predicts that while inflation is likely, there will be less of a gap in interest rates between nations. The differences in interest rates between two countries can be used to anticipate future changes in the exchange rate. Therefore, the degree of inflation determines whether or not there are arbitrage benefits in the foreign exchange market (Cheol and Bruce, 2012).

Purchasing Power Parity
The idea of purchasing power parity states that the ratio of prices for similar commodities in two different countries is the same as their respective exchange rates. There is a prospect for an

arbitrage profit if PPP is not the current exchange rate. Due to the difference in values, a country's currency may be seen as being overpriced or underpriced. PPP and the law of one price are therefore comparable. Whether or not the PPP is successful, it affects international trade. Under the PPP, variances in two countries' inflation rates balance out changes in their respective exchange rates. As a result, the countries will still engage in trade rivalry. However, if PPP fails, these countries' capacity to compete would suffer.

Empirical Review

Edih, Igemohia, and Faghawari (2022) investigated the opportunities and difficulties of Nigeria's maritime industry. Nigeria was found to be naturally gifted for exploring and reaping the benefits of marine trade. It was also discovered that the cited issues of inadequate funding, a lack of infrastructure, and others are impeding the efficient and effective functioning of these ports. The foreign exchange market in Nigeria was analyzed by Aigbovo and Izekor in 2022 to determine whether or not there were prospects for exchange rate arbitrage. Ex post facto and descriptive research designs were used in the investigation. The analysis demonstrates that there are arbitrage opportunities in Nigeria's foreign currency market. The study's conclusions also show that the parallel market clearly benefits consumers above the official government pricing.

Kehinde, (2022) used a straightforward regression analysis to assess the effect of cargo throughput on the maritime GDP in Nigeria between 1996 and 2016. The outcome showed that the volume of inbound and outbound cargo in the ports is directly related to the maritime GDP by 68%.In Karachi Stock Exchange, Mohammad, Naqvi, Lal, and Zehra (2021) investigated the applicability of the arbitrage pricing theory. using the Johansen co integration technique using monthly data from January 1985 to December 2008 for the study. They discovered that the Karachi Stock Exchange 100 index returns are only marginally related to the price of gold and the rate of inflation. For the time period spanning January 2000 and February 2007, Quadir (2021) examined the impacts of treasury-bill, interest rate, and industrial production macroeconomic variables on stock returns on the Dhaka stock exchange. applying the Autoregressive Integrated Moving Average model using monthly time series data. The findings demonstrate that while positive relationships between treasury bills, interest rates, industrial production, and market stock returns are shown by the Autoregressive Integrated Moving Average model, they are statistically inconsequential.

The impact of inflation rate risk, interest rate risk, exchange rate volatility risk, money supply change rate, real gross domestic product, and Treasury bill rate on investment performance in the Nigerian capital market is examined by Egart and Budonyefa (2019). Analysis using the Ordinary Least Square method and the models' overall usefulness were assessed. Based on our investigation, we discovered that the selected macroeconomic risk indicators do not adequately explain investment performance in the Nigerian capital market, contravening the goals of the arbitrage pricing theory.

METHODOLOGY

Research Design

The ex-post facto research design is used in this study. The study's target audience included all port operators as of December 31, 2022. The Nigerian Port Authority and Central Bank of Nigeria Statistical Bulletin were the sources of the data used in this study, with a focus on data from 1990 to 2022 (CBN, 2022) and NPA, 2022). Econometric Views (E-Views) 9.0 is the statistical software program used in this investigation. Additionally, to estimate the stated model, the study used Ordinary Least Square (OLS) estimation techniques.

Model Specification

This study modeled after the works of Ergart, M. (2022) but differs with the inclusions of Treasury bill in this study. However, the model for this study shall be stated below:

$MRTGDP = \beta_0 + \beta_1 INFRSK + \beta_2 EXCHR + \beta_3 MNSP + \beta_4 TRB + ųit$ (1)

MRTGDP	=	Maritime Contribution to GDP
INFRSK	=	inflation rate risk
EXCHR	=	Exchange rate volatility
MNSP	=	Money supply rate
TRB	=	Treasury bill rate
β_0	=	Constant Value
$\beta_1 - \beta_4$	=	Parameter Estimates

Operational Definition of Terms and Aprioiri Expectation:

Table 3.3: Operationalization of Targeted Variables

Code	Study Variable	Unit of Measurement	Aprioiri Expectation
Dependent Variable			
MRTGDP	Maritime Contribution to GDP	Total contribution maritime to GDP (annual %)	NIL
Independent Variables			
INFRSK	Inflation rate Risk	Inflation, consumer prices (annual %)	+
EXCHR	Exchange rate volatility	Official exchange rate (annual %)	+
MNSP	Money Supply rate	Total money in Circulation	+
TRB	Treasury bill	Treasury bill rate (annual %)	-

Source: Researcher's Compilation Based on Extant Empirical Studies (2023)

Data Analysis

Publication of the European Centre for Research Training and Development-UK

Descriptive Statistics

Table 4.1: Summary of Descriptive Statistics

	MRTGDP	INFRSK	EXCHR	MNSP	TRB
Mean	17.825634	16.457873	132.78773	0.989133	5.903988
Median	6.673522	14.786646	112.00487	6.098567	8.879467
Maximum	388.7300	72.52354	448.30036	47237.74	3786.140
Minimum	33.04400	5.062486	7.226733	27.53324	24.13008
Std. Dev.	5.389777	0.673455	0.844489	5.389456	7.589747
Observations	32	32	32	32	32

Source: E-Views 9.0 Output (2023)

From the descriptive result above, it was disclose that MRTGDP, INFRSK and EXCHR recorded mean-values of 17.825634, 16.457873 and 132.78773 respectively greater than their S.D values of 5.389777, 0.673455 and 0.844489. This implies that there exists a low volatility from the mean. Furthermore, MNSP and TRB recorded mean values of 0.989133 and 5.903988 respectively lower than its S.D-values of 5.389456 and 7.589747 respectively. This implies that, MNSP and TRB disperse much across the distribution.

Table 4.2 Correlation matrix

	MRTGDP	INFRSK	EXCHR	MNSP	TRB
MRTGDP	1.000000				
INFRSK	0.438766	1.000000			
EXCHR	0.173846	-0.235765	1.000000		
MNSP	-0.069084	0.273525	-0.278733	1.000000	
TRB	0.256633	-0.166476	0.233872	-0.387223	1.000000

Source: E-Views 9.0 Output (2023)

Table 4.2 above revealed a negative relationship on MNSP. While the rest variables attained a positive relationships. This result shows the correlation trend for INFRSK, EXCHR, and TRB as weak. To further reaffirm this, the VIF estimate as presented in table 4.3 reaffirmed that, the model is fit for prediction.

Table 4.3 Variance Inflation Factors

Variable	Coefficient Variance	Uncentered VIF	Centered VIF
INFRSK	0.117834	6.799944	1.746763
EXCHR	0.209389	3.178634	1.738933
MNSP	0.047878	6.453894	1.950943
TRB	0.022893	5.345643	1.674398

Source: Researcher's Computation via E-views. 9 (2023)

Augmented Dickey- Fuller Unit Root Test for Data Stationarity

The Augmented Dickey-Fuller test surveys the null hypothesis of a unit root compared to the alternative of stationarity.

Table 2: Augmented Dickey- Fuller Unit Root Test Result

Variables	Probability	T-Statistics	Order/Level of Integration
INFRSK	0.0222	-3.673445	I(0)
EXCHR	0.0145	-4.897457	I(0)
MNSP	0.0201	-3.790485	I(1)
TRB	0.0010	-6.799768	I(1)

Source: E-Views 9 Output

The rule of thumb for the Unit Root test is either at 5% or 10%. The probabilities indicates that the variables are all stationary at level (i(0)) and at 1st difference (I(1)). Therefore the hypothesis of non stationarity is thus rejected at level and first difference respectively. The variables were all included in the co-integration test.

Table 4.6: ARDL Bounds Test
Date: 10/05/23   Time: 02:53
Sample: 1990 2022
Included observations: 32
Null Hypothesis: No long-run relationships exist

Test Statistic	Value	K
F-statistic	5.022673	4

Critical Value Bounds

Significance	I0 Bound	I1 Bound
10%	2.26	3.35
5%	**2.62**	**3.79**
2.5%	2.96	4.18
1%	3.41	4.68

From the Table 4.6 above, F-statistic 5.022673 > the 5% critical values at I(0) and I(1) bounds; hence, we reject the null hypothesis and conclude that a long run relationship exist amongst the variables.

Regression Result

Dependent Variable: MRTGDP
Method: Least Squares
Date: 10/05/23 Time: 03:10
Sample: 1990 2022
Included observations: 32

Variable	Coefficient	Std. Error	t-Statistic	Prob.
C	0.672354	0.277566	2.422321	0.0838
INFRSK	-0.90688	0.389075	-2.33085	0.0104
EXCHR	0.389465	0.190948	2.039644	0.0159
MNSP	-0.45877	0.215791	-2.12597	0.0336
TRB	0.674368	0.293467	2.297935	0.0213

R-squared	0.893784	Mean dependent var	57834.78
Adjusted R-squared	0.689346	S.D. dependent var	15522.44
S.E. of regression	4345.881	Akaike info criterion	25.78475
Sum squared resid	3.095897	Schwarz criterion	10.78936
Log likelihood	-144.7589	Hannan-Quinn criter.	10.26747
F-statistic	4.783456	Durbin-Watson stat	1.836745
Prob(F-statistic)	0.000000		

Source: E-Views Version 9.0 (2023)

From the result above, the R-squared is 89.37%. Adjusted R-Squared shows that 68.93% of the total variations in MRTGDP are caused by (INFRSK), (EXCHR), (MNSP), and (TRB) while the remaining 31.07% are caused by other factor not captured in the model. The F. statistic of 4.387224 which is greater than 2% is statistically significant at a level of 0.000000. Lastly, the Durbin Watson Statistics value estimated at 1.836745 indicate that the model is not serially correlated.

Table 4.7: Summary of Hypotheses Testing

Hypotheses	Testable Forms	Prediction	Actual result	Decision
Ho_1	$INFRSK \neq MRTGDP$	Significantly positive	Negative significant with coefficient = 0.906876 & p-value 0.0104<0.05.	Accept Alternate
Ho_2	$EXCHR \neq MRTGDP$	Significantly positive	Positively significant with coefficient= 0.389465 & p-value = 0.0159 < 0.05.	Accept null
Ho_3	$MNSP \neq MRTGDP$	Significantly negative	Negatively significant with coefficient= --0.458766 & p-value = 0.0336<0.05.	Accept alternate
Ho_4	$TRB \neq MRTGDP$	Significantly positive	Positively significant with coefficient= 0.674368 & p-value = 0.0213<0.05.	Accept alternate

$\neq$ means has no significant effect
Source: Researcher's Computation (2023)

DISCUSSION OF REGRESSION RESULT

The empirical evidence obtained from Table 4.6 shows that there exists a negative significant relationship between INFRSK and MRTGDP with coefficient value of 0.906876. This implies that a % increase in INFRSK will lead to a decrease in MRTGDP by 90.68%. Also the negative coefficient affirms the negative effect on the maritime performance. This might be linked to the fact that the Arbitrage pricing theory is a more general model as it allows larger number of factors to affect returns which, in the real sense, some factors may not actually affect maritime performances. This finding is consistent with Quadir, (2021). Furthermore, the result shows a positive and significant relationship between EXCHR and MRTGDP with co-efficient value of 0.389465. The positive sign implies that a % increase in EXCHR will lead to an increase in MRTGDP by 38.94%. Furthermore it passed the test of level of significance with p-value <0.05% Again, the study supports the findings of Edih, Igemohia , and Faghawari (2022). Again, the empirical evidence shows a negative and significant relationship between MNSP and MRTGDP at 5% significant level i.e, MNSP has negative yet significant impact on MRTGDP. This further connotes that any one percent (1%) increase in MNSP will decrease MRTGDP -45.87%. The finding is in line with the study of Aigbovo and Izekor, (2022). Lastly the co-efficient of TRB displayed a positive slope with a statistical significant at 5% level of significance. This means that a positive and statistical significant relationship between TRB and MRTGDP exist. This also implies that a % increase in TRB will result to 67.43% increases in MRTGDP. This result supports the findings of Mohammad, Naqvi, Lal, and Zehra, (2021).

CONCLUSION AND RECOMMENDATIONS

The impact of arbitrage on port operations and marine performances in Nigeria from 1990 to 2022 was investigated in this study. With an emphasis on data from 1990–2022, data from the Nigerian Port Authority and Central Bank of Nigeria Statistical Bulletin were gathered.
The research draws the conclusion that (INFRSK), (EXCHR), (MNSP), and (TRB) have a substantial impact on maritime performances in light of the varied data. The study provided the following policy recommendations based on the conclusions that were confirmed:

On the basis of our analysis and findings, we recommend the following strategies:
1. Therefore, it is advised that port operators adopt stable macroeconomic policies to maintain the macrocosmic risk variables, such as the rate of inflation, the value of the dollar, and the rate of Treasury bills, at a controllable level that is beneficial to and consistent with maritime performances.
2. Despite the limited progress that has been made thus far, economic volatility has remained the biggest threat to the performance of the maritime industry. As a result, we offer strategic recommendations for driving port operating arbitrage.

3. For port operators to avoid monetary policies that encourage investments in fixed income and negatively impact marine performance, the money supply rate is absolutely essential.

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