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## **Evaluation of the Effects of Port Pricing Policy on Shipper's Demand for Port Services in Nigeria**

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### **Abstract**

The study evaluated the effects of port pricing policy on shipper's demand for port services in Nigeria from 1977 to 2022. The objectives of the study among other are to determine the influences of harbor dues charged by the Nigerian Port Authority (NPA) per tonnage of shipping import trade handled in the ports and to ascertain the relationship between harbor dues charged by the NPA and the trend of shipping export delivered by the shippers through the Nigerian seaports over the years. The study obtained historical data on harbor dues charged by the Nigerian port per ton of shipping trade handled in the port, the tonnage of shipping import and shipping export trade handled by the ports over the 45 years covered in the study

from the Nigerian ports authority. While the harbor dues charged per tonnage of trade was used as proxy for port pricing policy, the tonnages of shipping import and export trade handled were used to represent shipper's demand for port services over the period. Regression analysis method was used in each case to analyze the data obtained in order to provide answers to the research question. It was found that, it was found that, there is a significant impact of port pricing policy on shippers' demand for port services in Nigeria. Increase in harbor dues (port charges) paid by shippers (importers and exporters) between 1977 and 2022 saw an equally increasing trend in patronage to port services by the shippers over the period.

**Keywords:** Port-Pricing, Shipper-Demand, Port-Services, Shipping-Trade

### **1. Introduction**

The importance of the seaport and port operations in the maritime sector cannot be over emphasized. Seaports exert the most single dominant influence on maritime operations and logistics in terms of cost, productivity/output, time, efficiency and effectiveness of operations, than other nodes in the global supply chain networks (Osis *et al*, 2002). Aside the trade facilitative role of ports in which they serve the needs of the general shippers and freight forwarders, shipping companies and ship owners, haulage operators, oil and gas companies, among numerous other categories of port users; ports also function as revenue generation agencies of governments/states; at least, for the purpose of generating enough revenue that is sufficient to make the port economically self-reliant to run on its own without external financial support (Sodiq, Ndikom and Nwokedi, 2017) <sup>[23]</sup>.

The current era of port privatization and concession, more than any other time, exposed the need for port authorities and operators to commercialize operations and services aimed at enabling the public regulators and private port operators to provide the best of services at optimized cost and profit. This entails that prices fixed for port services must have the inherent potentials to ensure that port users enjoy fair and optimal port cost while port and terminal operators enjoy acceptable levels of profit without jeopardizing the interests of shippers and ship operators as consumers of port services. Thus, it envisages an era where port pricing should be used as a competitive tool to improve port performance by creating increased value and utility for port services rendered to shippers and ship operators among other categories of port users.

Port pricing in this context connotes the processes, tools and instruments by which the Nigerian Ports Authority (NPA) for examples arrives at and fixes prices for specified services offered by the port and terminal operators to the shippers and ship-owners as consumers of port services. Port pricing is viewed as veritable tool for determining prices which port users must pay for specific port services consumed. Port prices are thus rates, tariffs, and monetary charges for the purchase and use of

specified port services, determined by the use of port pricing policy (NPA, 2019, Ndikom *et al* 2017a) <sup>[10, 17]</sup>. It is important to note that the prices and charges prevailing in a given port terminal at any given time serve as instruments of revenue and have implications on port performance and productivity, capital cost recovery, profit potentials, development of competitive advantage and directions of demand and patronage for port services by all categories of port users (Bichou and Gray, 2004) <sup>[2]</sup>.

From the perspectives of the shippers and ship operators, the amounts paid as prices for port services consumed form the cost of port usage. The Nigerian Ports Authority (NPA) has implemented various port pricing policy regimes over the years between 1977 and 2022. The policies produced a multiplicity of port charges and rates paid for various port services. For example, ship dues, pilotage rates, harbor dues, wharfage, berthage and mooring dues, towage charges, conservancy dues, light dues, etc., form some of determinant charges paid by shippers and ship operators over the years. Government legislations and order remains the tool for arriving at the prices and rates charged by the NPA without consideration of the effects of these charges on shippers and ship operators as service consumers and how these charges will influence the directions of port performance.

For example, the Nigeria Port Authorities tariff and rates regulations of 1977, 1987, 1999 and 2004 are some of the major regulations detailing the tariff and rates of major port services as prices which port users must pay. The positions of the shippers as stakeholders in the Nigerian port sector are seemingly ignored in the development of the rates and charges while the influences of the implementation of the rates determined in the various port pricing policies have never been empirically investigated in recent times (Oghojafor, Kuye and Alaneme, 2012; Bamidele and Oludele, 2017) <sup>[20, 1]</sup>.

Shippers are believed to be the most affected by the increasing trend in port rates and charges in Nigeria since port-cost borne by the ship-owners are also transferred to the shippers whose inherent it as component part of the overall transportation cost of the commodity. The shippers in this context include all categories of importers and exporters of cargo that utilize Nigerian seaports in the shipping of their individual consignment. This include manufacturers, wholesalers, import and export representative and agent, industrial shippers, etc. (Nwokedi *et al*, 2022). The increasing trend in port cargo dues and port charges paid by the Nigerian shippers have implications on the cost of port usage, prices of imported goods and other goods transiting through the ports, as well as the rate of inflation in the prices of goods in the local economy. It implies that shippers may subsequently carry over these high port charges to reflect in the form of inflation in the prices of local goods (Olaogbebikan, Ikpechukwu, Akin and Enosoko, 2014) <sup>[22]</sup>.

Given the various port tariff and rates regulations in Nigerian port sector over the past 45 years, it has become important to ascertain to what extent shippers are affected and how they respond to the variations in port rates and tariffs charged in Nigerian ports. Thus, the study is aimed at determining the influences of the increasing trend in harbor dues charged by the Nigerian ports authority (NPA) on seaborne trade transiting through the seaports between 1977 and 2022. While the harbor dues represent the most significant charges paid by the shippers per ton of cargo/trade routed through the Nigerian port, the tonnages of

seaborne import and export trade handled in the Nigerian ports over the period is a metric for understanding the Nigerian shipper's demand for port services over the period. The objectives of the study are as stated below in section 1.1.

### 1.1 Objectives of the Study

#### The specific objectives of the study are:

1. To model the relationship showing the influences of harbor dues charged by the NPA on the tonnage of shipping imports routed through the Nigerian ports by shippers from 1977-2022.
2. To evaluate the impacts of harbor dues charged by the NPA on the tonnages of seaborne export trade delivered by the shippers through the Nigerian seaport over the period covered in the study.

### 1.2 Research Questions

1. Is there a significant relationship between tonnage of shipping import trade shipped through the ports and harbor dues charged in Nigeria ports from 1977-2022?
2. What is extent of impact of harbor dues charged by the seaports over the period on the tonnage of seaborne export trade handled in the ports?

### 1.3 Hypotheses

**H<sub>04</sub>:** The relationship between tonnage of shipping import trade shipped through the ports and harbor dues charged in Nigeria ports from 1977-2022 is not significant.

**H<sub>05</sub>:** There is no significant impact of harbor dues charged by the ports over the period on the tonnage of seaborne export trade handled in the ports.

## 2. Literature Review

Studies by Oghojafor, Kuye, and Alaneme (2012) <sup>[20]</sup> examined the problems bedeviling the operations of the Nigerian ports before the concession programme of 2006 and how well the concession has improved the performance of the Ports system and satisfied the yearnings of port users for improved port services. Secondary data was used on key port performance indicators that evidence demand and/or patronage for port services for shippers and ship-owners. The content analysis method was used to analyze the obtained while the findings indicates that while port concession has enabled the ports to generate more income for the Government, it has not satisfied the demand by port users for improved services because port charges and dues and overall cost of doing business in the ports continue to increase in the face of increasing cargo dwell time and ship-turnaround time. The study recommended that the port authorities need to improve port services to justify the increasing port rates in order that port users utility for consumption of port services be maximized (Oghojafor, Kuye, and Alaneme (2012) <sup>[20]</sup>.

Hercules (2002) <sup>[7]</sup> carried out a study on Competition, Excess Capacity, and the Pricing of Port infrastructure. The study noted the existence of controversy among stakeholders on what constitute the best approaches to port pricing that will guarantee port users satisfaction for services consumed while at the same time ensuring that cost invested in developing port infrastructure is recouped at satisfactory profit margin by investors. According Hercules (2002) <sup>[7]</sup>, the need to reconcile the impacts of port infrastructure investments on economic development, and the drive by

port authorities to recover investment costs contributes to the controversy on what should be the best approach to the pricing of port services. The study showed how Marginal Cost Pricing of port infrastructure can be a powerful 'pricing discipline' towards achieving cost recovery and fair competition among ports while guarantying the satisfaction of port users so that patronage to port services remain at acceptable levels. Hercules (2002) <sup>[7]</sup> advocated for the use of marginal cost pricing as better alternative to other port pricing strategies.

Emenike, Amamilo, Ajayi (2018) <sup>[5]</sup> carried out a study on the Assessment of Vessel Traffic and Customers Patronage at the Rivers Seaport, Port Harcourt, Rivers State, Nigeria. The study assessed vessel traffic and customers patronage at the Rivers' seaport using data obtained from both primary and secondary sources. They data obtained were analyzed descriptively using tables and standard deviation. The result of the study indicates that cost, efficiency cargo handling facilities, berthing space and government policy are very relevant in influencing users to patronage the ports for services. High cost of port usage and clearing charges also constitute major problems motivating the ship-owners and shippers to limit patronage to the port. The study recommended Government reduction and unification of the various charge/taxes that increase cost of port service consumption in the port.

Furthermore, Meersman, Pettersen Strandenes, and Van de Voorde (2014) <sup>[9]</sup> did a study on Port Pricing: Principles, Structure and Models. The study notes that price level and price transparency are input into shippers' choice of supply chain and transport mode. It thus analyzed the present port pricing structures in the light of the pricing literature and considers opportunities for improvement. It summarizes that current port pricing practice in most global ports is based on a rather linear structure which did not incorporate modern pricing tools such as price differentiation or revenue management. As a result, ports apply neither profit maximizing pricing nor pricing designed to exploit available capacity more efficiently resulting to a situation where price models adopted by most ports neither satisfy the profit objectives of the ports maximally nor enabled port users to maximize utility from port services consumed (Meersman, Pettersen Strandenes, and Van de Voorde, 2014) <sup>[9]</sup>.

Lastly, Nokuzola (2014) <sup>[12]</sup> did a study in title 'Towards Efficient Port Pricing: a Specific Look into South African Tariff Methodology'. The study notes that the South African economy would be severely constrained without the necessary port's infrastructure in place, while also observing that the efficiency of that infrastructure and pricing to use the infrastructure is of critical importance. It noted the impacts of high rates charged in South African ports on the inflation in prices of commodities in South African domestic

markets. In the views of Nokuzola (2014) <sup>[12]</sup>, port management structure, elasticity of demand for port service and the source of port funding determines the method used for port pricing.

The reviews of available empirical literature reveal the existence of gap in knowledge which no empirical studies have addressed. For example, available empirical studies have not been able to provide empirical information on the extent of impact of increasing trend in harbor dues charged by the NPA on the demand for port services by shippers. There is also no empirical information on the significance of the relationship port charges on the tonnages of seaborne import and export trade handled in the Nigerian seaports over the years. The lack of these aforementioned information has implications on the development of optimal port rates and charges in the Nigerian port sector and affects shippers demand for port services. These are the knowledge gaps which this study is determined to address.

### 3. Data and Methods

The study was designed to evaluate the effects of port pricing policy on shipper's demand for port services in Nigeria, using the major seaport comprised on the Lagos Apapa, Onne and warri Ports which handles more than 90% of the Country's shipping trade. It used quantitative research design method in which time series secondary data was used. Secondary data on the tonnage of shipping import trade and shipping export trade handled in the seaports between 1977 and 2022 was sourced from the NPA annual reports and used as proxies to represent shipper's demand for port services. The harbor dues charged by the port authority per ton of cargo transiting through the port each period between 1977 and 2022 was also obtained from the NPA tariffs and rates reports and used as proxy for port pricing policy. Each dataset covered a period of 45 years from 1977 to 2022. The ordinary Least Square (OLS) regression analysis method was used to analyze the data obtained while the t-test corresponding to the OLS regression was used to test the hypotheses.

The respective relationship showing the effects of harbor dues charged by the ports per tonnage of shipping import and export trade routed through the ports by the shippers was modeled using model specifications shown below:

$$CARGOPUT_{imports} = \beta_0 + \beta_1 HARBOUR_{imdues} + e(1)$$

$$CARGOPUT_{exports} = \beta_0 + \beta_1 HARBOUR_{exdues} + e(2)$$

The evaluation was implemented by using the SPSS software in order to achieve the objectives of the study.

### 4. Results and Discussion of Findings

**Table 1:** Relationship between Harbour Dues and freight traffic (imports) in Nigeria ports

		Mean	Std. Deviation	N		
Imports		23298305.2222	17571132.76360	45		
harbourduesimports		299.6274	353.26396	45		
Model	R	R Square	Adjusted R Square	Std. Error of the Estimate		
1	.907 <sup>a</sup>	.822	.797	7918360.97356		
Coefficients <sup>a</sup>						
Model		Unstandardized Coefficients		Standardized Coefficients	t	Sig.
		B	Std. Error	Beta		
1	(Constant)	9783867.074	3550348.462		2.756	.028
	harbourduesimports	45104.147	7924.849	.907	5.691	.001
		Minimum	Maximum	Mean	Std. Deviation	N
Predicted Value		9830022.0000	40093852.0000	23298305.2222	15933669.41893	45
Residual		-15323447.00000	9696119.00000	.00000	7406948.45697	45
Std. Predicted Value		-.845	1.054	.000	1.000	9
Std. Residual		-1.935	1.225	.000	.935	9
a. Dependent Variable: imports						

Source: Author’s calculation

The result on Table1 shows that the mean tonnage of cargo imported through the port harbours by importers/shippers per annum between 23298305.22tons with standard deviation of 17571132.7 while the average/mean harbor dues/rates per ton of import cargo shipped through the port harbours between 1977 and 2021 is 299.63naira with standard deviation of 353.26396.

The coefficient of correlation R indication the degree of correlation between the tonnage of imported cargo handled and harbor rates/dues charged over the period is 0.907; which shows a 91% high positive correlation between the importers (shippers) demand for/patronage to port services and rates of harbor dues charged by port authorities. over the period.

The model showing the relationship between the importer demand for port services and the rates charged by port

authorities as harbor dues over the period is:

$$CARGOPUT_{imports} = 9783867.074 + 45104.147HARBOUR_{imdues} \quad (1)$$

This implies that a unit increase in harbor dues paid by shippers per ton of imports through the port harbours increases the cargo throughput (importers/shippers’ patronage to port services) by 45104.15 tons. By implication, increasing the harbor dues/rates and charges for imports paid in the Nigeria ports leads to increasing shippers (importers) patronage to ports/harbor services.

The coefficient of determination R-square which measures the explanatory power of the model is 0.822. This indicates that about 82% variation in number of imported tonnages evidencing importers patronage to port services over the period is explained by harbor dues/rates as price charged by the NPA to shippers to harbor services.

**Table 2:** Relationship between Harbour Dues and freight traffic (exports) in Nigeria ports

		Mean	Std. Deviation	N		
Exports		12437632.1111	11303496.99786	45		
harbourduesexports		245.5319	289.60299	45		
Model	R	R Square	Adjusted R Square	Std. Error of the Estimate		
1	.884 <sup>a</sup>	.782	.751	5643031.96112		
Coefficients <sup>a</sup>						
Model		Unstandardized Coefficients		Standardized Coefficients	t	Sig.
		B	Std. Error	Beta		
1	(Constant)	3963407.609	2529699.108		1.567	.161
	harbourduesexports	34513.748	6889.132	.884	5.010	.002
Residuals Statistics <sup>a</sup>						
		Minimum	Maximum	Mean	Std. Deviation	N
Predicted Value		3990787.2500	22973580.0000	12437632.1111	9995284.43220	45
Residual		-11255246.0000	7342969.00000	.00000	5278573.05528	45
Std. Predicted Value		-.845	1.054	.000	1.000	45
Std. Residual		-1.995	1.301	.000	.935	45
a. Dependent Variable: exports						

The result on Table 2 shows that the mean tonnage of cargo exported through the port harbours by exporters/shippers per annum between 1977 and 2021 is 12437632.1111tons with standard deviation of 11303496.99786 while the average/mean harbor dues/rates per ton of export cargo shipped through the port harbours between 1977 and 2021 is 245.5319 naira with standard deviation of 289.60299.

The coefficient of correlation R indicating the degree of correlation between the tonnage of exported cargo handled and harbor rates/dues charged over the period is 0.884; which shows 88% high positive correlation between the

exporters (shippers) demand for/patronage to port services and rates of harbor dues charged by port authorities over the period.

The model showing the relationship between the exporters (shippers) demand for port services and the rates charged by port authorities as harbor dues over the period is:

$$CARGOPUT_{exports} = 3963407.609 + 34513.74HARBOUR_{imdues} \quad (4)$$

This implies that a unit increase in harbor dues paid by shippers/exporters per ton of exports through the port

harbours increases the exporters/shippers patronage to port services by 34513.75 tons. By implication, increasing the harbor dues/rates and charges for exports paid in the Nigeria ports led to increasing patronage to port/harbor services by exporters over the period.

The coefficient of determination R-square which measures the explanatory power of the model is 0.782. This indicates that about 78% variation in tonnage of exported tonnage evidencing exporters' patronage to port services over the period is explained by harbor dues/rates as charges by the NPA to shippers/exporters.

#### 4.1 Test of Hypotheses

**Table 3:** Test of hypotheses  $H_{01} - H_{02}$  that deals with the impacts of port prices on shippers' demand for port Services in Nigeria

Hypotheses	t-score	t-table	p-value	Sig. (P-value<0.05)	Decision
$H_{01}$	5.691	2.26	0.001	Yes	Reject $H_{04}$
$H_{02}$	5.010	2.26	0.002	Yes	Reject $H_{05}$

Source: Authors calculation

**$H_{01}$  states that:** The relationship between tonnage of imports shipped through the ports and harbor-dues in Nigeria ports from 1977-2021 is not significant. The test statistic shows a t-score of 5.691, t-table of 2.26, p-value of 0.001 at 0.05 level of significance. Since (**P-value<0.05**), we reject null hypothesis  $H_{01}$  and accept the alternate hypothesis to conclude that: The relationship between tonnage of imports shipped through the ports and harbor-dues in Nigeria ports from 1977-2021 is significant.

**Similarly,  $H_{02}$  states that:** There is no significant impact of harbor dues charged by the ports over the period on the tonnage of exports handled in the ports. The test shows a t-score of 5.010, t-table of 2.26 and p-value of 0.002. Since  $0.002 < 0.05$ , we again reject null hypothesis  $H_{02}$  to conclude that: There is a significant impact of harbor dues charged by the ports over the period on the tonnage of exports handled in the ports.

### 5. Summary of Findings, Conclusion and Recommendations

#### 5.1 Summary of Findings

1. The impacts of harbor dues on shipper's demand for import processing via the port is that a unit increase in harbor dues paid by shippers per ton of imports through the port harbours increases the cargo throughput (importers) by 45104.15 tons.
2. Similarly, a unit increase in harbor dues paid by shippers/exporters per ton of exports through the port harbours increases the exporters/shipper's patronage to port services by 34513.75 tons.
3. The relationship between tonnage of imports shipped through the ports and harbor-dues in Nigeria ports from 1977-2021 is significant.
4. There is a significant impact of harbor dues charged by the ports over the period on the tonnage of exports handled in the ports.

#### 5.2 Conclusion

There is a significant impact of port pricing policy on both ship-owners and shippers (port users) patronage to port services in Nigeria. Increase in ship dues and harbor dues (port charges) paid by ship-owners and shippers (importers

and exporters) between 1977 and 2021 saw an equally increasing patronage to port services by both ship-owners and shippers.

#### 5.3 Recommendations

It is recommended that the empirical relationship between port pricing plan/policy and the demand for port services by both shippers and ship-owners be considered always in the development of port charges as the competitiveness of ports depended to a large extent on the level of patronage to port services which in turn is influenced by the port pricing policy.

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