Analysis of the Impact of Port Operations on Nigerian Economy: A Focus on Apapa Seaport

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Abstract

This study analyzed the impact of port operations on Nigerian economy, with a focus on Apapa port. Data sourced from Nigeria Ports Authority's operational bulletin were analyzed using multiple regression model. It was found that gross registered tonnage of the vessel is significantly contributing to the Nigerian gross domestic product (GDP) at 0.05 significant level, and that cargo throughput and vessel traffic have positive impact on the economy but are not significantly influencing the Nigerian gross domestic product at 0.05 significant level. Vessel gross registered tonnage should be used as the basis for assessing port dues since it bears positive significance on Nigerian economy. The Nigerian government should also develop the country's inland infrastructure of rail and water ways to facilitate swift transfer of cargo from the ports to the hinterland and improve port operations by reducing congestion both in the ports and on roads.

Keywords: Port operations, Economy, Gross Registered Tonnage, Cargo Throughput and Vessel Traffic

1.0 Introduction

Shipping has for a long time been recognized as one of the strong catalysts for socio-economic development. Smith (1776) noted that a business working in a country town without links to the outside world can never achieve high levels of efficiency because its small market will limit the degree of specialization. Because shipping is one of the cheapest and efficient modes of transportation over long distances, it has since the ancient times been at the forefront of opening up the world for trade, and has become a major driver of the process of globalization. Trade has a quantitatively large, significant, and robust positive effect on income (Frankel, 1999). The recent trade liberalization has reduced tariff and non-tariff barriers, the effect being an increase in the relative importance of transport cost as a determinant of trade (Amjadi, 1995). Clearly, the reduction in artificial barriers has created a situation where the effective protection provided by transport cost has gone higher than one provided by tariffs (Clark et al, 2004). Increased transport cost causes the price of intermediate and capital goods to rise resulting in an increase in the cost of domestic production and decrease in exports and trade. There is empirical evidence that suggests that doubling transport cost could lead to a drop in trade by 80% or more (Limao, 2001). Higher transport cost leads to lower levels of foreign investment, reduced access to technology and

knowledge, lower savings ratio, decline in exports, and a decline in employment. The doubling of transport cost causes a drop in the rate of economic growth of more than half per percentage point (Radelet, 1998). The impact of transport cost on economic growth is increasing and varying across regions (Sanchez et al., 2003). Limao (2001) found that raising transport cost by10 percent reduces trade volumes by more than 20 percent and that poor infrastructure accounts for more than 40% of predicted transport costs. Radelet (1998) also observed that shipping costs reduce the rate of growth of both manufactured exports and GDP per capita. A seaport which is the most significant node in sea transport is responsible for a major proportion of transportation cost. It should be operated with high efficiency to reduce transport cost and boost the economy.

Theoretical approaches about the relationship of seaport developmental investments on the economic growth of the island regions can be attributed to modified neoclassical growth theory referred to as the theory of endogenous development (Grossman & Helpman, 1991). Sjafrizal (2008) considers that the amount of output (goods and services) which is produced by an economic activity is determined by the availability and quantity of production factors used. In addition, he found a positive correlation between marine transportation infrastructure and economic growth of archipelagic regions. Hence, the causative relationship between the development of the seaport and economic growth was established. The coherence of the physical structure of transportation and the physical structure of economy is needed, and the parameters should be in synergy. If the economic growth of a region is not supported by the transportation infrastructure, the GDP of the region will experience a decline. The growth of GDP could be either positive or negative, depending on the throughput volume of goods in the region. The throughput volume of goods depends on the vessel holds capacity or dead weight tonnage (DWT) and the visiting frequency of ships (Call). The ship DWT affects the overall length of the ship (LOA), where the LOA affects the length of the berth (LB).

Transportation networks have a positive causal effect on per capita growth rate across all sectors (Banerjee, 2009). Likewise, Essoh (2013), in his research concluded that the port activities resulted in an increase in fiscal revenue and accelerated economic growth. The achievement of certain economic levels is believed to encourage the development of the transportation system (Pangihutan, 2008). Overtime, the maritime industry has substantially changed from an industry that was always international in its character to a truly global entity with routes that span across hemispheres, transporting raw materials, spare parts and finished goods. Maritime transportation plays a major role in the national and international trade and economic growth. The seaborne trade represents over 90% of the international trade in the world.

Port operations such as scheduling of arriving vessels, allocation of wharf space and cranes to serve the vessels, loading and unloading of cargoes, yard operation and gate operations are enhanced through the provision and availability of efficient port infrastructure. Hence, efficient port infrastructure and operations is reflected in the volume of cargo and revenue generated by the port, which acts as a boost to the economy.

Port operation is very vital to Nigerian economy. Data obtained from port operations data can indicate if a port is efficient or not. The number of vessels that called at the port in 2016 had a decline of 2.72% when compared to the previous year. Also comparing the operations data to that of the neighbouring ports shows that the performances of the neigbouring ports are more robust. Hence, Nigerian port operations need to be reviewed to enable the ports to improve their competitive position in the regional and global market. Port congestions, high container dwell time, high turnaround time of vessels and trucks, inadequate of port facilities such as berths, etc have tremendously negated the operational performance of Apapa port of Lagos. These drawbacks in port activities have made Apapa port operationally inefficient leading to increases in demurrage charges and operating cost of vessels. The implied economic implication of the aforementioned inefficiencies is that most shippers will prefer to call at other ports with less congestion, better port facilities and sophisticated cargo handling equipment. The economy is also experiencing increases in the prices of consumable goods, cut-off-flow during operations by the production companies, decrease in per capital income of port employees and general decreases in the revenue accruable to the port.

Nigeria is a major force in international trade, with 70% of goods coming to the West, and Central Africa destined to Nigeria. Out of which 80% of the traded goods are transported by sea (UNCTAD, 2009). Therefore, the study of port operations is crucial to the sub-region. The World Bank African infrastructure country diagnostics assessment of ports in Sub-Saharan Africa ranked Nigeria as the top reformer (Vagliasindi, 2009). World Bank (2008) report put the total private sector investment in Sub-Saharan African ports at $1.3 billion, with 62 percent related to the container terminals and 32 percent to multipurpose terminals and little in the bulk cargo facilities. Nigeria accounts for 55 percent of the total private sector investment in the sub-region and the biggest single deal is Apapa Container Terminal in Lagos, Nigeria. Therefore, it becomes imperative to study the outcome of the programme that attracted such a huge investment in the sub-region and also ascertain the contributions of such an investment to the economy. This is besides the fact that governments in the sub-region seeking to embrace improvement in port operations and infrastructure could leverage on the findings of this study.

It is in the light of the foregoing that this study sought to analyze the impact of port operations on the Nigerian economy using Gross Domestic Product as the major economic index and port operations indicators such as Ship Traffic, Cargo Throughput and Gross Registered Tonnage from 2000 to 2015 with a view to determining the impact of gross registered tonnage of vessels on Nigerian gross domestic product; ascertaining the influence of cargo throughput on Nigerian gross domestic product and determining the significant influence of ship traffic on Nigerian gross domestic product.

2.0 Methodology

The study was carried out in the Lagos Port Complex which is located at the Apapa Area of Lagos and consisted of Apapa Port and a container terminal now called APM Terminal. It occupies a land area of about 120 hectares. Apapa port has conventional berths that service all cargo types. These include 24 berths for handling dry cargo and two berths for loading and discharging petroleum products. Six of the 24 berths are designated as container berths. The total quay length of the port is 1km and the average draught of the berths is 11.5m. It has 13 transit sheds with a total storage space of 78,869 square metres and 8 warehouses with a total space of 58,042 square metres. It also has support facilities for cargo on transit to ECOWAS countries. Apapa Port Complex was released on concession to four terminal operators namely, ABTL, ENL, GDNL and APMT. The Plate of Apapa Port Complex is presented in Figure 1.

Figure 1. Apapa Port Complex
Source: Google Earth, 2016.

Secondary sources were deployed for data collection in this study. The data set contains information on gross domestic product, cargo throughput, gross registered tonnage and vessel traffic from 2000 to 2016. Multiple regression analysis was used to model the relationship between the gross domestic product (GDP) and port operations variables. Ineffective port performance was identified as a constraint on port operations. Statistical Package for Social Sciences (SPSS), version 14.0 was used as the analysis tool. The results of the analysis were subjected to different validation criteria to determine the reliability of the estimates. The statistical reliability of the estimates of the model parameters was also determined. Under this criterion, the model was subjected to the following statistical tests:

i. Coefficient of correlation (R)
ii. Coefficient of determination (R^2)
iii. t- distribution (t-test)
iv. Analysis of variance (ANOVA/F-ratio)

The relationship between Nigerian economy and the key port operations indicators were specified as follows:

$$Y = \beta_0 + \beta_1 X_1 + \beta_2 X_2 + \beta_3 X_3 + \beta_4 X_4 + e_n \quad (3.1)$$

$$\beta_1 = \frac{(\sum y x_1)(\sum x_2^2) - (\sum y x_2)(\sum x_1 x_2)}{(\sum x_1^2)(\sum x_2^2) - (\sum x_1 x_2)} \quad (3.2)$$

$$\beta_2 = \frac{(\sum y x_2)(\sum x_1^2) - (\sum y x_1)(\sum x_1 x_2)}{(\sum x_2^2)(\sum x_1^2) - (\sum x_1 x_2)} \quad (3.3)$$

$$R^2 = \frac{\beta_1 \sum y x_1 + \beta_2 \sum y x_2}{\sum y^2} \quad (3.4)$$

$$GDP = \beta_0 + \beta_1(GRT) + \beta_2(THROUGHPUT) + \beta_3(NOV) + \beta_4(NOE) + e \quad (3.5)$$

Where;

GDP = The Gross Domestic Product for the period of Study

GRT= Gross Registered Tonnage of the Port (in tonnes)

$THROUGHPUT$ = Cargo Throughput (in tonnes)

NOV = Number of Vessels

R^2 = Coefficient of Determination

β_0 – is the intercept;

β_1 - β_4 are the slope coefficients for the independent variables;

e_n – is the error term.

3.0 Results and Discussions

Table 1 shows the value of gross registered tonnage, cargo throughput, number of vessels, number of employees and gross domestic product of Nigeria from 2000 to 2015. The GDP was increasing from the year 2000 to 2014 except a fall in 2009. The gross registered tonnage was also started increasing from 2006 to 2015 while the cargo throughput was increasing from 2007 till 2011 before started falling 2012; though it increased to the highest in 2015. The number of vessels was higher between 2000 and 2006 than the number of employees but from 2007 to 2015, the number of employees dropped abruptly to almost equal to the number of vessels (Figure 1).

The regression model for Apapa Ports Complex was constructed based on the beta values displayed in Table 3. Thus, the multiple linear regression equation is as follows;

$$\text{GDP} = -73037304227.9 + 1.29X_1 + 0.2X_2 + 0.086X_3 + 0.095X_4$$
(Equ.1)

The above equation shows that GDP will increase in average by 1.29 of a unit increase in X_1, increase in average by 0.2 of a unit increase in X_2, increase in average by 0.086 of a unit increase in X_3 and increase in average by 0.095 of a unit increase in X_4. The regression line equation is statistically significant (F=39.005; p=0.000) (Table 4).

From Table 3, the computed level of significance for Gross Registered Tonnage is 0.000 and the specified level of significance is 0.05. Hence, there is significant relationship between gross registered tonnage of the vessel and Nigerian gross domestic product. It is thus interesting to note from this result that the gross registered tonnage of Apapa Port contributed significantly to the level of gross domestic product in Nigeria.

Equally revealing is the fact that this model shows about 97% level of relationship between the explanatory variables and the Nigeria's economy, represented by GDP as the dependent variable (as shown in the ANOVA result in Table 4). Similarly, with R^2 value of about 93%, it therefore suffices to say that the explanatory variables have been able to explain at least 93% of the variations in the level of gross domestic product (Table 2). Also, the results of other, test statistics, like the adjusted R^2, of about 91% equally mean that after adjusting for errors, the variation in the explanatory could still explain at least 91% of the total variation in GDP (Table 2) . From the estimated model of the relationship, the coefficient of gross registered tonnage bears a positive sign in the equation, indicating that a unit increase in the value of the gross registered tonnage will bring about an increase of 1.291 units in the level of gross domestic product; all things being equal (Equ. 1).

From Table 3, the computed level of significance for cargo throughput is 0.485 and the specified level of significance is 0.05. Hence, there is no significant relationship between cargo throughput and Nigerian GDP despite the fact that cargo throughput is the most important economic indicator. However, the study demonstrates an interesting correlation between the variables. For instance, with an R value of 97% (Table 2), it means that there is a fairly strong correlation or relationship between Nigeria's GDP as the dependent variable and the independent variables.

Also from Table 3, the computed level of significance for vessel traffic is 0.552 and specified level of significance is 0.05. Hence, there is no significant relationship between ship traffic volume and Nigerian GDP. On the nature of relationship between the ship traffic volume and the level of Nigerian GDP, the study posited about 97% level of correlation between the variables under investigation (Table 2). From the resulting model, a unit increase in the ship traffic volume will lead to about 0.086 unit increase in the level of Nigeria's gross domestic product (Equ. 1).

Table 1. Gross domestic product, gross registered tonnage, cargo throughput and number of vessels

S/N	Year	Gross Domestic Product (USD)	Gross Registered Tonnage	Cargo Throughput (Tonnes)	Number of Vessels	Number of Employees
1	2000	46385996228	12885387.3	11008000	1275	3991
2	2001	44138014092	16270840.1	13898000	1431	3943
3	2002	59116868251	14382383.7	14306000	1384	4103
4	2003	67655540108	16974346.5	14576000	1346	3920
5	2004	87845403978	17187581.9	15152000	1456	3747
6	2005	112248324605	16346289.7	16931000	1398	3022
7	2006	145429764861	18347443.6	15113000	1512	3920
8	2007	166451213395	23745901.8	18567000	1478	1182
9	2008	208064753766	24166539.5	20309000	1410	1269
10	2009	169481317540	26251391	21119000	1471	1391
11	2010	369062464570	28946291	22005000	1563	1489
12	2011	411743801711	32869251	22808353	1564	1487
13	2012	460953836444	31513987	21065520	1421	1480
14	2013	514966287206	34446291	21730426	1498	1509
15	2014	568498939784	36969456	20667487	1690	1540
16	2015	481066152870	39476368	23845616	1644	1555

Source: Nigerian Ports Authority and World Development Indicators (2016)

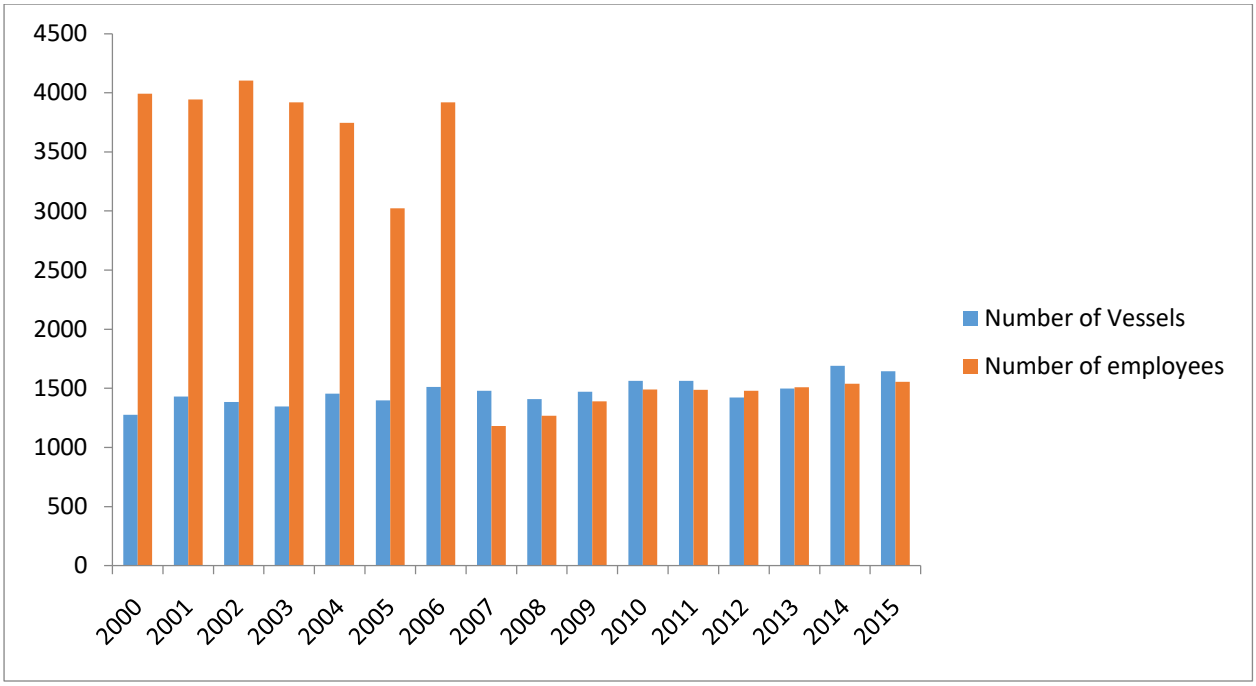

Figure 1. Number of Vessels and Employees

Table 2. Multiple Regression Analysis

Model	R	R Square	Adjusted R Square	Std. Error of the Estimate
1	.967[a]	.934	.910	56562884857.

a. Predictors: (Constant), Number of Employees, Number of Vessels , Gross Registered Tonnage, Cargo Throughput

Table 3. Coefficients of all the explanatory variables

Model	Unstandardized Coefficients		Standardized Coefficients	t	Sig.
	B	Std. Error	Beta		
(Constant)	-73037304227.9	337494269804.		-.216	.833
Gross Registered Tonnage	27951.311	5091.760	1.291	5.490	.000
Cargo Throughput	-9728.042	13459.980	0.200	-.723	.485
Number of Vessels	-151202252.829	246394043.261	0.086	-.614	.552
Number of Employees	14417246.795	31145697.451	.095	.463	.652

Table 4. Significance of the model for Apapa Port Complex using ANOVA

Model	Sum of Squares	Df	Mean Square	F	Sig.
Regression	4991643390510292000000000.000	4	1247910847627573000000000.000	39.005	.000
Residual	3519295937688519300000000.000	11	319935994335319900000000.000		
Total	5343572984279144500000000.000	15			

a. Dependent Variable: Gross Domestic Product

4.0 Conclusion and Recommendations

This study examined the ways of improving Nigerian economy through effective and efficient port operations. The port operations indicators that were assessed include cargo throughput, ship traffic volume and gross registered tonnage. Apart from the fact that the findings of this study could guide the policy and decision making of government particularly in ports operations and generally in shipping, it has revealed that effective port operations is important in boosting Nigerian economy because about 90% of Nigerian bound imports pass through the seaport. It has equally established the fact that Cargo throughput, ship traffic volume and gross registered tonnage are port operations indicators influenced Nigerian GDP. Vessel gross registered tonnage was found to have a positive significant impact on Nigerian economy while the influences of cargo throughput and ship traffic volume were not significant. The study therefore recommended that vessel gross registered tonnage should be used as the basis for assessing port dues since it has a positive significant impact on Nigerian economy; there should be improvement in the number and capacity of cargo handling equipment to enhance port operations vessel turnaround time and berth occupancy; and the Nigerian government should develop the country's inland infrastructure of rail and water ways. This will not only facilitate swift transfer of cargo from the ports to the hinterland but will also greatly improve ports operations by reducing congestion both in the ports and on roads.

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