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Understanding the Nexus between Seaport Efficiency and Nigeria's Non-Oil Export Performance: A Case study of Lagos Seaports 2000 -2020

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ABSTRACT: This research focused on assessing the relationship between seaport efficiency and Nigeria's non-oil export. The western ports of Lagos were selected as the Decision-Making Units (DMU) for this study covering the period of 2000 to 2020. Two stage estimation process was employed. Data Envelopment Analysis (DEA) was deployed in the first stage to generate the efficiency index required to test the relationships. In the second stage, the efficiency index so generated was introduced as one of the independent variables in a multiple regression model, using Autoregressive Distributed Lag Model (ARDL). The finding shows that seaport efficiency has a positive and significant relationship with non-oil export in the long run and a positive but insignificant relationship with non-oil export in the short run. The study concluded that seaport efficiency has a direct and positive impact on Nigeria's non-oil export. This study therefore recommended the effective implementation of reforms of critical infrastructure particularly the transportation sector for improved efficiency by the federal and state governments; the deepening and close monitoring of the concessionaires by the Nigerian Ports Authority, to meet their investment and operational expectation in the concession agreement.

KEYWORD: Seaport Efficiency, Non-Oil Export

1. INTRODUCTION

The value of non-oil export as a percentage of Nigeria's total export has maintained a steady growth trajectory since 2006 (see appendix). This continuous growth is suggestive of a relationship between the seaport reforms of the Nigerian government which was completed coincidentally in 2006. The overarching objective of the port reform was the improvement in port's operational performance and efficiency in terms of increase in cargo throughput and number of ship calls (Nigerian Ports Authority, 2018). Although the growth trajectory remains steady since 2006, the 13.1% share of non-oil export recorded in 2019 by the National Bureau of Statistics (2020), may be considered somewhat very low, given the over 40% share of non-oil export previously attained in 1979 before the downward spiral (Ezike & Ogege, 2012).

The previous low performance of the non-oil export recorded over the years, shows the level of Nigeria's dependence on crude oil export, and how far behind her quest for economic diversification has been. As Okoh (2004) explained, the diversification of the Nigerian economy has become imperative given the levels of volatility recorded in the past three decades in the international oil market, and the pressure it exerts on government revenue. More so, the fact that crude oil is an exhaustible asset, makes the dependence on crude oil for about 90% of her revenue and foreign exchange earnings unreliable in the drive for a sustainable development of the Nigerian economy (Onodugo, Ikpe & Anowor, 2013).

Nigeria's non-oil export can be categorized to include agricultural goods, raw material goods, solid mineral goods, manufactured goods and energy goods (Aigheyisi, 2015; NBS, 2020). In other words, the excluded goods from this category includes crude oil and other petroleum products. A key component of the Nigeria's non-oil export is termed 're-export'. According to Nairametrics (2020) an online business journal, 're-exports are all imported goods (other than goods declared in transit or transshipment) which are subsequently re-exported'. The non-oil exports, which are the products of the non-oil sector holds the key to sustainable growth and development of Nigeria's economy. Ezike and Ogege, (2012) observed that the non-oil sector has a vast potential that is largely underutilized and has the potential to drive Nigeria's economic growth. A well-developed non-oil export sector according to Adeniyi Aladejare and Saidi (2014) will provide employment opportunity for the people, while the earnings from non-oil export will contribute significantly to the reduction of the strains on the balance of payment position and may even improve it.

The poor performance of the non-oil export as recorded previously, may not be due to lack of policy initiatives on the part of the Nigerian government. Institutional structures such as the Nigerian Export Promotion Council (NEPC) and Nigerian Export-Import Bank (NEXIM) were established as far back as 1976 to administer export incentives. Other supportive policies by the government according to Onodugo *et al* (2013), include protectionism policy in the form of import substitution, structural adjustment programme, trade liberalization, and export promotion policy of 1990s, such as the establishment of export processing zones.

While the effects of these policy initiatives by the government may not have yielded the positive results in accordance with the policy objectives, the report from Central Bank of Nigeria trade statistics (see appendix), indicated that the ratio of the non-oil export to total export had some spikes in growth in 1986 through 1988, 1998 and 2002, periods prior to the completion of the seaport reform. These spikes in growth were followed by a long drop and slowdown in the ratio of non-oil export to the total export. However, since 2006, growth in the share of non-oil export as a ratio of total export has been steady up to 2019 prior to the Covid 19 global pandemic recorded in 2020. The question that arises therefore is; whether the recorded growth in the share of non-oil export was a mere coincidence or an indication of the effect of the reform in the Nigeria seaport? Recall that the key objective of the port reform was to enhance the operational performance and efficiency of the Nigerian seaports. Hence this study however is carried out with a view to determining the relationship between the port efficiency achieved within the study period and non-oil export performance using the Lagos Port Complex Apapa and TinCan Ports both located in Lagos state Nigeria as the case study and as the decision making units (DMU). The choice of this DMU is justified by the NBS ports statistics (2018) report which indicated that about 98% of container traffic, 60% of ocean going vessels and about 48% total cargo throughput in 2017, were recorded at these ports. The 98% container traffic is an indication that these ports constitute the gate way for non-oil trade merchandise in Nigeria.

This study is organized into five sections. The first section focuses on the introduction of the paper, while literature review and theoretical framework are discussed in the second section. In section three, the methodology adopted for the study is treated, while section four deals with the presentation and analysis of results. Section five focuses on conclusion and recommendations.

2. LITERATURE REVIEW AND THEORETICAL FRAMEWORK

2.1. Empirical Literature Review

There is the dearth in the availability of related empirical literature on the relationship between seaport efficiency and non-oil export performance in both Nigerian and African contexts. Studies by Olaniyan (2004), Anthony and Somiara (2010), Efobi and Osubuohiem (2011), for instance, focused on assessing the determinants of non-oil export performance in Nigeria. None of these studies however considered seaport efficiency as a variable. Similar studies by Adeniyi Aladejare and Saidi (2014), and Yelwa, Babalola, and Akinwolere, (2020), studied the determinants of non-oil export, and impact of non-oil export on Nigeria's economic growth respectively. Aigheyis (2015) also carried out a study on the effects of import penetration and Foreign Direct Investment inflows on the performance of Nigeria's non-oil exports in the period from 1981-2012, using the methodology of ARDL (Bounds Test) approach to co-integration and error correction analysis.

The studies that considered port performance and trade include; Mlambo (2021), which tested the relationship between Africa's port performance and trade performance, for a period covering 2005 to 2018 using Autoregressive Distributed Lag Model (ARDL) panel technique.

Similarly, Haque-Munim and Schramm (2018) studied the broader economic contribution of seaborne trade, from a port infrastructure quality and logistics performance perspective, employing the technique of a Structural Equation Model (SEM). In the same vein, Blonigen and Wilson, (2008) incorporated port efficiency estimate in a gravity trade model, and found that improved port efficiency significantly increases trade volumes.

The studies reviewed have focused on the relationship between port performance and seaborne trade, while combining the oil and non-oil trade merchandise in their analyses. None of the studies has attempted to disaggregate the trade and exports into oil and non-oil and assess the relationships between seaport efficiency and non-oil export performance. This has therefore created a gap in literature that this study intends to fill.

2.2. Theoretical Framework

The Solow growth model, an exogenous model of economic growth, forms the theoretical framework for this study, following the path created by Park and Seo (2016). The model assumed an aggregate production function of the form; Y=f(K, L) which assumed constant return to scale. The Cobb-Douglas production function presentation of the model gives thus;

$$Y(t) = K(t)^{\alpha} A(t) L(t)^{1-\alpha} \quad (2.1)$$

Where Y is gross domestic product, K is the stock of capital, L is labour, and 'A' (technology or technological progress) represents the productivity of labour which grows overtime at exogenous rate, while (*t*) represents time.

The aggregate function is assumed to satisfy a series of technical conditions;

a. It is increasing in both arguments; some conditions;

$$F_K > 0, F_L > 0$$

b. It displays decreasing marginal returns to each factor;

$$F_{KK} < 0, F_{LL} < 0$$

c. It displays constant returns to scale, and

$$AF(\lambda K, \lambda L) = \lambda AF(K, L)$$

d. It satisfies the Inada condition;

$$F_K = F_L = +\infty$$

The remarkable fact about the Solow model in our theoretical framework is the basis of introduction of additional variables in the existing Harrod-Domar model, hence the addition of labour and technical progress in Solow's view provided a better platform to achieve economic growth. This therefore will form the basis of the introduction of efficiency and cargo throughput as some of the independent variables in the study equation.

3. METHODOLOGY

This research was carried out through a two-phase computational process. The emphasis of the first phase was the determination and measurement of the seaport efficiency within the study period for the DMU, employing the Malmquist Total Factor Productivity (TFP). The Malmquist TFP is one of the techniques of Data Envelopment Analysis (DEA) amenable to panel data in its analysis. In the second phase of the study, the efficiency index obtained in the first stage is applied as one of the independent variables in the multiple regression model to assess the relationship between seaport efficiency and the Nigeria's non-oil export performance.

3.1. Model Specification

3.1.1. Data Envelopment Analysis (DEA) Malmquist Total Factor Productivity Index

The DEA is a non-parametric method of determining the efficiency of a decision-making unit with single or multiple inputs output variables, and rather than the traditional regression analysis, the DEA develops nonparametric frontiers over data with the use of linear programming technique (Cullinane & Wang, 2006). The Charnes, Cooper and Rhodes (1978) (CCR) model of DEA was adopted based on the assumption of constant return to scale. Hence to determine the efficiency of the DMU, the study had to solve the mathematical programing model given below;

Maximize h_o *(u, v)* = $\frac{\sum_{r=1}^{s} \ u_r y_r^0}{\sum_{i=1}^{m} \ v_i x_i^0}$ (3.1)

Subject to:

$\frac{\sum_{r=1}^{s} \ u_r y_j^0}{\sum_{i=1}^{m} \ v_i x_{ij}^o} \leq i, j = 1,2, \dots \dots, n$ (3.2)

$U_r \ \geq 0, r = 1,2, \dots .., s$ (3.3)

$v_i \ \geq 0, i = 1,2, \dots ., s$ (3.4)

Where:

X_{ij} = represents *the observed input of the* i_{th} *type of the* j_{th} *DMU* (x_{ij} >0, i=1,2, …, *m,j = 1,2,…..,n).*

y_{ij} *= the observed amount of output of the* r_{th} *type of* j_{th} *DMU* (y_{ri} *> 0, r = 1,2,….,S,j = 1,2,….,n)*

U_r *and* V_i *= linear programming determined weights*

The dual for the linear programing problem is as follows;

Min $Z_0 = \vartheta_0$ (3.5)

Subject to:

$\sum_{j=1}^{n} \lambda_j \chi_{ij} \ \geq \ y_r^0, r = 1,2, \dots ., s$ (3.6)

$\theta_0 x_i^0 - \sum_{j=1}^{n} \quad \lambda_j x_{ij} \ \geq \ y_r^0, i = 1,2, \dots .., m$ (3.7)

$\lambda \ \geq 0, j = 1,2, \dots .., n$ (3.8)

In solving the mathematical programing problem, the efficiency score for the DMU was derived.

3.1.2. Multiple Regression Model

The study adapted the Cobb-Douglas function-like model of Ndubisi (2016) with some modifications to meet the specific objectives of the study.

$$Y_t = e^{\beta_0} K_t^{\beta_1} L_t^{\beta_2} P_t^{\beta_3} Z_t^{\beta_4} \quad (3.9)$$

Where;

Y = Aggregate output

L = Labor force

K = Capital stock

Z = Vector of other Institutional factors in the aggregate production process

$$P = \frac{C}{(1+i)^{\lambda}} \quad (3.10)$$

And "C" is the cargo throughput of all the DMUs in a year, "*i*" is the measure of port's inefficiency, and "λ" is the weight of the inefficiency in the allocative process. For this study, the variable "Z" represented the vector of other macroeconomic variables that contributed to non-oil export performance. The resulting Cobb-Douglas function therefore became.

$$Y_t = e^{\beta_0} K_t^{\beta_1} L_t^{\beta_2} P_t^{\beta_3} Z_t^{\beta_4} \quad (3.11)$$

Adding natural logarithm on both sides produced a linear equation thus;

$$ln\, Y_t = \beta_0 + \beta_1 lnK_t + \beta_2 lnL_t + \beta_3 lnP_t + \beta_4 lnZ_t \quad (3.12)$$

Substituting the value of P in equation ***3.10*** into equation ***3.12*** gave us

$$\beta_3 ln\, P_t = \beta_3 ln\, \frac{C}{(1+i)^{\lambda}} = ln\, C - \varphi ln\, (1-i) \quad (3.13)$$

Where $\varphi = \beta_3 \lambda = \beta_5$

Substituting equation ***3.13*** into ***3.12*** produced;

$$ln\, Y = \beta_0 + \beta_1 ln\, K + \beta_2 ln\, L + \beta_3 ln\, C - \beta_5 ln\, (1-i) + \beta_4 ln\, Z \quad (3.14)$$

Representing the log of the variables with a lower case simplified this to;

$$y = \beta_0 + \beta_1 k + \beta_2 l + \beta_3 c - \beta_5 (1-i) + \beta_4 z \quad (3.15)$$

The importance of the equation (3.15) is that the influence of port on the non-oil export performance is felt through the increase in volumes of cargo throughput represented by β_3, which must have to be greater than zero to ensure the impact is felt. The influence can also be felt through a reduction in inefficiency (1-*i*), which by implication means increase in efficiency, hence the adoption of efficiency index in our study, and for this to be effective, the coefficient β_5, must have to be positive. Where the coefficient β_5 is positive, the implications therefore will be that the port efficiency has a positive contribution to non-oil export performance.

With the introduction of the error term (μ_t) into the equation (3.15) we had:

$$y = \beta_0 + \beta_1 k + \beta_2 l + \beta_3 c - \beta_5 (1-i) + \beta_4 z + \mu_t \quad (3.16)$$

Where the μ_t is a random disturbance term introduced to capture the statistical noise. The disturbance is assumed to be independently distributed with zero mean and constant variance.

$\mu_t \sim id(0, \sigma_\mu^2)$.

This model for this study therefore is;

$$EXPT = \alpha_0 + \alpha_1 CAP + \alpha_2 POP + \alpha_3 CARGO - \alpha_5 EFF(1-i) + \alpha_4 EXCH + \alpha_6 INF + \alpha_7 INT + \mu_{2t} \quad (3.17)$$

Where;

GDP: Economic Growth Rate

EXPT: Non-Oil Export

DOP: Degree of Trade Openness

CAP; Capital Stock

POP; Growth Rate of Population

EXCH; Real Exchange Rate

CARGO, Total Volumes of Cargo Throughput

EFF: The Mean Efficiency Change Index

INF: Inflation Rate,

INT: Real Interest Rate

μ_t : Error Term

3.1.3. Nature and Source of Data

Data for this study was sourced from the Nigerian Ports Authority's (NPA) ports statistics, Nigerian Ports Authority year books, annual reports and other publications of the agency. Some of the data for economic variables were obtained from the Central Bank of Nigeria (CBN), National Bureau of Statistics' (NBS) annual abstract statistics, and the World Bank's World Development Indicators (WDI) annual report. The data were sourced for the study period of year 2000 to 2020 and consisted of input-output variables from the operations of the seaports including cargo throughput in metric tons, terminal areas in measured in hectares, quay lengths in meters, and cargo handling equipment in their numbers.

3.1.4. The ARDL Estimation Technique

the testing and estimation of short run and long run relationships among economic variables. This study made use of the Autoregressive Distributed-Lag Model (ARDL), a procedure first developed by Pesaran and Shin (1999), but later enhanced by Pesaran, Shin and Smith (2001). The ARDL was adopted due the sample size, and its nonrestrictive properties on a single order of integration on the variables of study (Nkoro & Uko, 2016; Aswata, Nnyanzi & Bbale, 2018; Mohammed, 2021): The linear ARDL model specification is given below in equation 3.18.

$$\Delta Log(EXPT)_t = \alpha_0 + \alpha_1 T + \beta_1 Log(EXPT_{t-1}) + \beta_2 Log(CAP_t) + \beta_3 Log(POP_t) + \beta_4 Log(CARGO_t) + \beta_5 Log(EFF_t) + \beta_6 Log(EXCH_t) + \beta_7 Log(INF_t) + \beta_8 Log(INT_t) + \sum_{i=0}^{k} \lambda_{1i} \Delta Log(EXPT_{t-1}) + \sum_{i=0}^{k} \lambda_{2i} \Delta Log(CAP_{t-1}) + \sum_{i=0}^{k} \lambda_{3i} \Delta Log(POP_{t-1}) + \sum_{i=0}^{k} \lambda_{4i} \Delta Log(CARGO_{t-1}) + \sum_{i=0}^{k} \lambda_{5i} \Delta Log(EFF_{t-1}) + \sum_{i=0}^{k} \lambda_{6i} \Delta Log(EXCH_{t-1}) + \sum_{i=0}^{k} \lambda_{7i} \Delta Log(INF_{t-1}) + \sum_{i=0}^{k} \lambda_{8i} \Delta Log(INT_{t-1}) + \theta ECT_t + \mu_t \quad (3.18)$$

4. DATA ANALYSIS AND SUMMARY OF FINDINGS

4.1. Malmquist TFP Index

Table 4.1: Summary of Annual Means of Malmquist Total Factor Productivity Efficiency Index

Year	EFFCH	TECHCH	PECH	SECH	TFCH
1 (2000)	1.000	1.000	1.000	1.000	1.000
2 (2001)	1.014	1.262	1.000	1.014	1.281
3 (2002)	0.950	1.029	1.000	0.950	0.978
4 (2003)	1.045	1.019	1.000	1.045	1.065
5 (2004)	0.913	1.064	1.000	0.913	0.971
6 (2005)	1.032	1.091	1.000	1.032	1.127
7 (2006)	1.232	0.893	1.000	1.232	1.100
8 (2007)	1.049	1.229	1.000	1.049	1.289
9 (2008)	1.071	1.115	1.000	1.071	1.195
10 (2009)	1.076	0.913	1.000	1.076	0.983
11 (2010)	0.975	1.123	1.000	0.975	1.095
12 (2011)	1.020	1.07	1.000	1.020	1.100
13 (2012)	1.040	1.871	1.000	1.040	0.906
14 (2013)	1.015	1.022	1.000	1.015	1.037
15 (2014)	1.000	1.050	1.000	1.000	1.050
16 (2015)	1.000	0.958	1.000	1.000	0.958
17 (2016)	1.000	0.937	1.000	1.000	0.937
18 (2017	1.000	1.008	1.000	1.000	1.008
19 (2018)	0.997	1.043	1.000	0.997	1.041
20 (2019)	0.999	0.256	1.000	0.999	0.255
21 (2020)	0.998	0.650	1.000	0.998	0.648
Mean	**1.020**	**0.948**	**1.000**	**1.020**	**1.001**

Source: Computation by the Author using DEA Generated Series, 2021

Table 4.1 shows the aggregated annual Malmquist Total Factor Productivity Index for the DMU decomposed into efficiency change (EFFCH), technical efficiency change (TECHCH), pure technical efficiency change, (PECH), scale efficiency change (SECH), and total factor productivity change (TFCH). The efficiency or productivity improvements is recorded when the index score of Malmquist TFP or any of the decompositions is greater than unity and vice versa. However, when the TFP values or any of the decompositions equal to unity, it signifies that the DMU have experienced no improvement in efficiency or productivity or both. As in Ndubuisi (2016), the efficiency index for our study is the mean annual efficiency change (EFFCH) for the ports of study shown in the second column of the table. The Overall, the mean efficiency score within the study period is 1.020 which signifies a marginal efficiency improvement in the ports of study within the study periods.

4.2. Unit Roots Tests

Table 4.2: Unit Root without Structural Break Test (Conventional)

		LEVELS			FIRST DIFFERENCE			
	Variable	**Constant**	**Trend Constant**	**None**	**Constant**	**Trend Constant**	**None**	**ID**
ADF	**EXPT**	0.750932 (0.9892)	-3.663019* (0.0524)	2.295939 (0.9914)	-3.844545 (0.0124)	-4.43289** (0.0164)	-1.634845 (0.0948)	I (1)
	CAP	-9.501615 (0.0000)	-9.123093*** (0.0000)	-7.568999 (0.0000)	-5.787757 (0.0002)	-5.555622*** (0.0019)	-6.024607 (0.000)	I (0)
	POP	1.245443 (0.9972)	-1.439097 (0.8162)	-3.008186 (0.0046)	-3.423684 (0.0231)	-4.053077** (0.0248)	-2.504713 (0.0154)	I (1)
	CARGO	-2.244772 (0.1980)	1.648921 (1.0000)	-0.295975 (0.5656)	-5.969546 (0.0001)	-6.949053*** (0.0001)	-6.150210 (0.0000)	I (1)
	EFF	-2.225727 (0.2050)	-2.401442 (0.3658)	0.056736 (0.6881)	-3.198593 (0.0392)	-3.843853** (0.04197)	-3318977 (0.0026)	I (1)
	EXCH	-1.749811 (0.3927)	-2.414343 (0.3618)	-0.303222 (0.5636)	-3.778129 (0.0112)	-3.819656** (0.0383)	-3.887937 (0.0006)	I (1)
	INF	- 3.729745 2 (0.0124)	-3.492495* (0.0690)	-0.263048 (0.5763)	-4.888956 (0.0012)	-4.670973*** (0.0091)	-5.054021 (0.0000)	I (1)
	INT	-2.025580 (0.2744)	-3.243353 (0.1059)	-0.733816 (0.3858)	-4.830666 (0.0012)	-4.835388*** (0.0056)	-4.897099 (0.0001)	I (1)

Source: Extract from Eviews 11 Output, 2021. NB: *, ** and *** imply significance at 10%, 5% and 1% respectively. ADF is Augmented Dickey Fuller Unit Root Test, PP is Philip Peron Unit Root Test. Values in parenthesis (…) indicate MacKinnon (1996) one-sided p-values.

Stationarity test was conducted to check the time series properties and determine the order of integration of the variables in order to ascertain their credibility and usability. The stationarity tests adopted are the conventional unit root test without structural break. The standard or conventional Augmented Dickey-Fuller (ADF) test results at zero order of integration {levels or I(0)}, and first difference, I(1) for all variables in two categories of equations (intercept with no trend, and intercept with trend). The result shows a mixed order of integration. The variable CAP under ADF unit root test was stationary at level, I(0); while variables EXPT, POP, EXCH, INF, EFF, and INT were stationary at first difference I(1).

4.3. Empirical Results

Table 4.3 shows the summary of the ARDL estimation compartmentalized into panels A, B and C. Panel A shows the Bound Cointegration Test, and Panel B shows the long and short run results of the ARDL, while Panel C shows the results of post estimation tests to validate the robustness of the regression model. The ARDL lag order of (1, 1, 1, 1, 1, 0, 1, 1) was automatically selected through the Schwarz Criterion (SIC) maximum lag length selection criteria. The coefficients of multiple determinations R^2 and Adjusted R^2 are 0.954 and 0.933. That is, about 95.4 percent and 93.3 percent of the explanatory variables explain the variation in the dependent variable of the model.

Further post estimation tests conducted as shown in **Panel C**, confirms the reliability of the estimates. For instance, the Breusch and Godfrey (BG) test for serial correlation shows an insignificant F-statistic, which confirms the absence of autocorrelation. This however lays to rest the observation made in the correlation matrix in the descriptive statistics. Similarly, the Breusch Pagan and Godfrey (BPG) test for heteroscedasticity shows insignificant F-statistics hence null hypothesis of Homoscedasticity is not rejected implying that the variances are homoscedastic.

Table 4. 3: Summary of ARDL Model Two in Equation 3.18

PANEL A: BOUND COINTEGRATION TEST			
F-statistics	**I(0)**	**I(1)**	**Level of Significance**
9.619845***	1.92	2.89	10%
	2.17	3.21	5%
	2.73	3.9	1%
PANEL B: ARDL (1,1,1,1,1,0,1,1)			
Long Run			
Variable	**Coefficient**	**t-Statistics**	**Prob**
C	0.674951	0.155428	0.8826
LOG(EXPT(-1))	-0.317743**	-2.838557	0.0363
CAP(-1)	-0.041296**	-2.630548	0.0465
POP(-1)	-1.489124	-2.214715	0.0776
LOG(CARGO)	0.424499	1.539814	0.1842
LOG(EFF(-1))	7.766627**	3.051516	0.0284
EXCH	-0.010636*	-2.134027	0.086
INF(-1)	0.050686	0.989688	0.3678
INT(-1)	0.057509	0.718194	0.5048
D(CAP)	-0.012858	-1.41529	0.2161
D(POP)	3.339351	0.758849	0.4822
DLOG(CARGO)	-0.239273	-1.179349	0.2913
DLOG(EFF)	1.241828	0.661457	0.5376
D(INF)	-0.03675	-1.506265	0.1923
D(INT)	-0.118272*	-2.079505	0.0921
Short Run			
CAP	-0.129967	-1.601196	0.1702
POP	-4.68657*	-2.211685	0.0779
LOG (CARGO)	1.335984	1.915027	0.1137
LOG(EFF)	24.44312	1.778435	0.1355
EXCH	-0.033473	-1.959654	0.1073
INF	0.15952	1.040101	0.346
INT	0.180992	0.608372	0.5695
C	2.124204	0.15564	0.8824
ECT(-1)	-0.317743***	-15.00348	0.00001
PANEL C: POST ESTIMATION TESTS (ROBUSTNESS CHECK)			
Diagnostics	**F-Statistics**	**Df**	**Prob**
Linearity (RESET)	1.021511	1,4	0.3603
Serial Correlation	6.280677	2,3	0.0846
Heteroschedasticity	2.306194	14,5	0.1822
JB-Normality Test	0.14208		0.931425
$Wald_{LR}$ Test			
R^2	0.954493		
Adj. R^2	0.93349		

Source: Extract from EViews 11 Output, 2021.

NB: *, ** and * imply significance at 10%, 5% and 1% respectively**

In addition, the RESET test confirms that the models are stable and void of any specification error. The linearity test retains the null hypothesis that the models are correctly specified. The Jarque-Bera (JB) statistic for the models are insignificant, hence, suggesting the null hypothesis may not be rejected. It evidently demonstrates that the residuals of the model are normally distributed.

Panel A of table 4.3 depicts the bound cointegration test for the long-run relationship of the variables in our Model. Since the F-statistics (9.619) lie above the upper bound of I(1), at 1 percent critical value (3.9), we can conclude that there is co-integration among the variables. The Error Correction Model shows the speed of adjustment to shocks and dynamics of the dependent variables to disequilibrium caused by the explanatory variables. The Error Correction Term in our model in Panel B is (-0.317) and significant at 1 percent and has a negative sign as expected. This shows a speed of adjustment of 32 percent. In other words, it takes about three years and a month (100/32=3.125) for any deviation from short-run equilibrium to be restored in the long-run. **Panel B** reports the long run and short-run results of the model. The estimates indicate that gross fixed capital formation (CAP) has an inverse and significant relationship with non-oil export (EXPT) in the long run at 5 percent level of significance, and an inverse but insignificant relationship in the short run. The result equally shows that populations growth rate (POP) has a negative and insignificant relationship with non-oil export (EXPT) in the long and short run. Similarly, the result shows that cargo throughput (CARGO) has a positive but insignificant relationship with non-oil export.

The result also shows that seaport efficiency (EFF) has a positive and significant relationship with non-oil export in the long run at 5 percent level of significance, but positive and insignificant relationship at short run. This result is in conformity with the a priori expectation of a positive relationship. The result shows that a percentage increase in seaport efficiency will lead to an increase in non-oil export (EXPT) by 776.7 percent in the long run. Real exchange rate (EXCH) has an inverse but insignificant relationship with non-oil export in both the long and short run. Similarly, Inflation (INF) and real interest rate (INT) have positive but insignificant relationship with EXPT in the long run and short run.

5. CONCLUSION

The result of this study has shown a positive and significant relationship between seaport efficiency and Nigeria's non-oil export within the study period. This therefore suggest that the witnessed increase in the ratio of non-oil export as against the total export may not be a coincidence after all, but as a positive impact of seaport efficiency emanating from the reform efforts of the Nigerian government.

This study therefore recommends the effective implementation of reforms of critical infrastructure particularly the transportation sector for improved efficiency by the federal and state governments; the deepening and close monitoring of the concessionaires by the Nigerian Ports Authority, to meet their investment and operational expectation in the concession agreement. The study equally recommends the increased oversight of the Nigerian Ports Authority on the terminal operators to ensure that the planned investment in technology and modern cargo handling equipment to further enhance the seaport operational efficiency.

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Appendix: Nigerian Foreign Trade, Oil and Non-Oil (in Billions of Naira)

	Imports (cif)			Exports & Re-Exports (fob			Ratio of Non-Oil
Year	Oil	Non-Oil	Total	Oil	Non-Oil	Total	to Total Export %
1981	0.12	12.72	12.84	10.68	0.34	11.02	3.11
1982	0.23	10.55	10.77	8.00	0.20	8.21	2.48
1983	0.17	8.73	8.90	7.20	0.30	7.50	4.02
1984	0.28	6.90	7.18	8.84	0.25	9.09	2.72
1985	0.05	7.01	7.06	11.22	0.50	11.72	4.24
1986	0.91	5.07	5.98	8.37	0.55	8.92	6.19
1987	3.17	14.69	17.86	28.21	2.15	30.36	7.09
1988	3.80	17.64	21.45	28.44	2.76	31.19	8.84
1989	4.67	26.19	30.86	55.02	2.95	57.97	5.10
1990	6.07	39.64	45.72	106.63	3.26	109.89	2.97
1991	7.77	81.72	89.49	116.86	4.68	121.54	3.85
1992	19.56	123.59	143.15	201.38	4.23	205.61	2.06
1993	41.14	124.49	165.63	213.78	4.99	218.77	2.28
1994	42.35	120.44	162.79	200.71	5.35	206.06	2.60
1995	155.83	599.30	755.13	927.57	23.10	950.66	2.43
1996	162.18	400.45	562.63	1,286.22	23.33	1,309.54	1.78
1997	166.90	678.81	845.72	1,212.50	29.16	1,241.66	2.35
1998	175.85	661.56	837.42	717.79	34.07	751.86	4.53
1999	211.66	650.85	862.52	1,169.48	19.49	1,188.97	1.64
2000	220.82	764.20	985.02	1,920.90	24.82	1,945.72	1.28
2001	237.11	1,121.07	1,358.18	1,839.95	28.01	1,867.95	1.50
2002	361.71	1,150.99	1,512.70	1,649.45	94.73	1,744.18	5.43
2003	398.92	1,681.31	2,080.24	2,993.11	94.78	3,087.89	3.07
2004	318.11	1,668.93	1,987.05	4,489.47	113.31	4,602.78	2.46
2005	797.30	2,003.56	2,800.86	7,140.58	105.96	7,246.53	1.46
2006	710.68	2,397.84	3,108.52	7,191.09	133.59	7,324.68	1.82
2007	768.23	3,143.73	3,911.95	8,110.50	199.26	8,309.76	2.40
2008	1,315.53	4,277.65	5,593.18	9,861.83	525.86	10,387.69	5.06
2009	1,068.74	4,411.91	5,480.66	8,105.46	500.86	8,606.32	5.82
2010	1,757.14	6,406.83	8,163.97	11,300.52	710.95	12,011.48	5.92
2011	3,043.60	7,952.27	10,995.86	14,323.15	913.51	15,236.67	6.00
2012	3,064.26	6,702.30	9,766.56	14,259.99	879.34	15,139.33	5.81
2013	2,429.38	7,010.05	9,439.42	14,131.84	1,130.17	15,262.01	7.41
2014	2,215.03	8,323.75	10,538.78	12,006.97	953.53	12,960.49	7.36
2015	1,725.22	9,350.84	11,076.07	8,184.48	660.68	8,845.16	7.47
2016	2,384.41	7,095.95	9,480.37	8,178.82	656.79	8,835.61	7.43
2017	2,615.45	8,189.39	10,804.85	12,913.24	1,074.90	13,988.14	7.68
2018 [1]	3,686.18	9,758.93	13,445.11	17,845.87	1,434.17	19,280.04	7.44

Source: Central Bank of Nigeria, Statistical Bulletin, 2018.