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Spatial and temporal dimensions of container traffic in Nigerian seaports

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Abstract: Generally speaking, cargo demand traffic forecasts are needed tools to rationalize the investment decisions in ports. However, little studies have been carried out in determining the magnitude of container cargo traffic at Nigerian ports, this creates a lacuna that needs to be filled up. The purpose of this study is to ascertain the spatial and temporal dimensions of container traffic in Nigerian seaports from 1990 to 2017. The study uses a survey design and employed descriptive and multivariate statistics to analyze the data. It demonstrates that Nigeria imports lots of commodities in containers than it exports in containers because most of the country's exports are crude oil and non-containerized goods. Thus the reason for traffic congestion at the ports and the high cost paid by Nigerian shippers for imported containerized cargo. The study further showed that both imported and exported container traffic had a positive trend in the time series. From the findings, we have shown the need for understanding the magnitude of container traffic at the ports as it helps Ports Authorities in operational decisions regarding port capacity utilization.

Keywords: spatial dimension, containerized cargo, container traffic, capacity utilization

1. Introduction

The port's capacity plays a crucial role in the port's competitive position to meet demand, avoid congestion, and hence, decrease the cost and time lost at the port and increase productivity that is of importance to all the stakeholders (Yasmine, 2016). Meersman et al. (2003) emphasized that the relative port competitiveness advantage is one of the important factors that determine the potential demand and is significantly considered by policymakers when dealing with investment decisions concerning increasing port capacity. However, the decision to provide new capacities and investments in the port should be supported by growing potential demand. Meersman and Van de Voorde (2014) emphasized the importance of studying the trade-off between the costs and

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benefits of excess capacity and related funding. Therefore, demand traffic forecasts are needed as a tool to rationalize the investment decisions

The growth in carrying capacity of container vessels has been high since the start of containerized transport in 1956 and has continued to be on the increase (UNCTAD, 2012). One unique characteristic of the container port industry is that competition between container ports are becoming more intensive than it was in previous years. Ports used to be seen as monopolistic because of their geographical location is exclusive and immovable. However, there has been a tremendous improvement of an international container and intermodal transportation, which has created a change in the market from a monopoly structure to a more competitive structure in many parts of the world. Many container ports no longer enjoy the freedom yielded by a monopoly over the handling of cargoes from their hinterland. Instead, they have to compete for cargo with their neighbouring ports It is this distinctive feature that characterized this industry and that has led to an interest in efficiency with which it utilizes its resources.

Brooks et al. (2014) brought to the fore that the under-capacity of the port infrastructure can cause logistics bottlenecks and put a constraint on growth. Therefore, port policymakers rely on long-term demand forecasts to justify their decisions for port infrastructure projects and avoid unneeded costly under/over-investment.

Thus the objective of this study is to analyze the spatial and temporal dimensions of container traffic in Nigerian seaport which can assist Port policymakers involved in ports infrastructure investment-decision making process. This is based on the assumption that container throughput is not only related to the economic activity but also other dynamic factors such as the port competitive position, logistical services provided and hinterland connectivity.

2. Literature review

The port sector is closely related to the changes in global economic activity and international trade. The global financial crisis in 2008 had a significant impact on the activities of the port. Moreover, the changes in oil prices affect freight traffic to the port sector. Hence, following the evolutions of the economic activity allows forecasting the demand side. On the supply side, the port capacity plays a crucial role in the competitive position of the port to meet demand, avoid congestion, and hence, decrease the cost and time lost at the port and increase productivity, which is of importance to all the stakeholders (Meersman 2009): the shipping lines, port authority, shippers, terminal operators, and investors. However, the decision to provide new capacities and investments in the port should be supported by growing potential demand. Therefore, port decision-makers rely upon demand traffic forecasts to support decisions related to operation and investment (Yasmine, 2016). Many studies investigated the relationship between economic activity and the maritime freight to forecast the port traffic. However, the diversity across the studies is large, making it difficult to classify the literature review. From the methodology perspective, some studies are quantitative, some are qualitative and some are a combination of both. Form the level of analysis, studies may aim at forecasting the total port traffic, a specific cargo category (liquid, dry bulk) or even at a disaggregated level looking into the commodity level. From the application perspective, some studies forecast at the port level, while others are conducted at a regional level or a range of ports. From the objective and forecast horizon, some studies are short-term using monthly or quarterly data, others are aimed at long-term forecasts for investment decisions. However, this study focused on container cargo throughput at Nigerian ports.

Since the beginning of the containerization in the middle of the 20th-century transports, costs have dramatically decreased. Before there were containers, transport of goods was so expensive that few items were shipped halfway across the country, much less halfway around the world (World shipping council 2016). Eighty percent of seaborne cargo is moved in containers (Ramani 1996; Rodrique et al 2006) which confirms the importance of ocean trade by containers. Efficiency in container ports is therefore highly needed and extremely important. Ports are significant for international trade; ports are providing a linkage from international to regional or local transport systems. In recent years, the world has experienced major growth in global trade, which has led to the importance of having efficient ports. Due to seaports being so critical for trade and the supply chain, both authorities and managers have taken interest in improving port efficiency (UNCTAD 2012).

Containerships with carrying capacities of 18,000 TEU offers a significant reduction in average carrying cost per container (Prince, 2012). The increases in vessel size have resulted in the practice of consolidating ships call at fewer ports. In the process of port consolidation, as container port throughput volumes increases in a particular port, there is likely to be significant downward pressure on productivity unless capacity can be increased quickly. Modern ships require modern equipment for operations, however, Nigerian ports seem to lack the ability to adapt efficiently to meet the ever-changing and developing needs of industries. Most of the studies have focused on the significance of containerization to ship frequency at ports, intermodalism, terminal productivity, port competitiveness and connectivity, as well as port infrastructure development. Others have provided insight into determinants of container port choice by shippers, the influence of site and situation on port favourability and strategies for development of container ports. All these studies are developmental in context and were carried out in order to reposition those ports in the global maritime industry. However, most of these studies were carried out in the developed ports of countries other than Nigeria. Fewer studies have been carried out on the adoption and utilization of containerization on the development of seaports in Nigeria (Aderamo and Adeyanju, 2013; Jaja, 2011; Ukpong, 1998; Odumosu, 1998; Filani and Ikporukpo, 1987). None of these studies has been able to provide an analysis of the Spatial and temporal dimensions of container traffic in Nigeria. Thus the gap this study seeks to fill.

3. Materials and methods

Import traffic of containers is the number of containers received at the ports within a specific period in contrast to export traffic which is the number of containers transported out of the ports within a particular period which can be loaded or empty. In this study, both loaded and empty containers were used to estimate the traffic at all ports. The total traffic data were collected from the Nigerian Ports Authority in Lagos. The data collected were the official record of the Nigerian Ports Authority and National Maritime Safety and Administration.

The study made use of Descriptive Statistical tools, such as percentages, tabulations, charts, and graphic illustrations, to present data and establish the trend of container traffic in Nigeria. The Time Series analysis was applied to determine the periodic changes in container traffic in Nigeria (i.e., trend analysis of container traffic through the ports – for imports and exports was done from 1990 to 2017). The incremental analysis was done for the yearly traffic of containers as well as percentage annual contributions of imported and exported container traffic was done to see how much of each made up the total throughput at the seaports. Also, linear regression was used to analyze the contribution of containerized cargoes to the total cargo throughput at each port. This was done using the Excel software package.

The trend analysis in the form;

If e_t is the residual associated with observation at time *t,* then the test statistic is

$$d = \frac{\sum_{t=2}^{T}(e_t - e_{t-1})^2}{\sum_{t-1}^{T} e_t^2}, \quad (1)$$

Where, T is the number of observations. If one has a lengthy sample, then this can be linearly mapped to the Pearson correlation of time-series data with its lags. Since d is the approximately equal to 2(1-r), where r is the sample autocorrelation of the residuals, d =2 indicates no autocorrelation. The value of d always lies between 0 – 4. If the Durbin-Watson statistics is substantially less than 2, there is evidence of positive serial correlation. If Durbin-Watson is less than 1.0, there may be cause for alarm. Small values of d indicate successive error terms are positively correlated. If d > 2, successive error terms are negatively correlated. In regression, this can imply an underestimation of the level of statistical significance.

4. Results

Container traffic in Nigeria has been on the increase, with some fluctuation probably due to national or global depression and recession. It can be seen that imported container traffic rose from what was recorded in 1990 and had a more significant increase in 1992 (22%), the sanctions that followed the political impasse of Nigeria saw a decrease in 1993, 1994 (-17% and -23% respectively). However, when the Military Government of General Sani Abacha refocused the economic trade from the

Western world, to the Asians, notably China, an increase of 10% was recorded in 1995. There were not enough trading as some adjustments needed to be done hence a negative balance (-15%) in 1997, with the coming of the civilian government there was a steady increase in the volume of containers in Nigeria (though a decline of -23% that year, 1999).

Table 1: Container traffic in Nigeria

Year	Total Throughput (exported + imported)	Total Imported (containerised + non-containerised)	Total exported (containerised + non-containerised)	Total Container Traffic (TEU)	Imported Container (TEU)	% Change in Imported Container	% Contribution for all throughput	% Contribution for total containerised traffic from 1990-2017)	Exported Container (TEU)	% Change in Exported Container	% Contribution for all throughput	% Contribution for total containerised traffic from 1990-2017)	Total Imported Non-containerised	Total Exported Non-containerised
1990	794229	665770	128459	123101	100121	-	15	2	22980	-	18	4	565649	105479
1991	1147046	1021178	125868	136230	109848	9.715245	11	2	26382	14.8041775	21	4	911330	99486
1992	1165288	1029821	135467	152791	134278	22.23982	13	2	18513	-29.827155	14	3	895543	116954
1993	692651	566031	126620	135342	111564	-16.9157	20	2	23778	28.439475	19	4	454467	102842
1994	491436	377293	114143	111300	85627	-23.2485	23	1	25673	7.96955169	22	4	291666	88470
1995	1169406	1073932	95474	113238	94580	10.45581	9	1	18658	-27.324426	20	3	979352	76816
1996	558955	478004	80951	101803	80857	-14.5094	17	1	20946	12.2628363	26	3	397147	60005
1997	905833	798933	106900	121582	102660	26.96489	13	2	18922	-9.6629428	18	3	696273	87978
1998	748254	620980	127274	207456	183517	78.76193	30	3	23939	26.5141106	19	4	437463	103335
1999	1108077	963187	144890	165379	141594	-22.8442	15	2	23785	-0.6433017	16	4	821593	121105
2000	863539	727533	136006	187358	161146	13.80849	22	2	26212	10.20391	19	4	566387	109794
2001	1184647	994116	190531	213402	190467	18.1953	19	3	22935	-12.501908	12	4	803649	167596
2002	1100456	904907	195549	217686	198778	4.363486	22	3	18908	-17.558317	10	3	706129	176641
2003	1119127	932569	186558	243645	222865	12.11754	24	3	20780	9.90057119	11	3	709704	165778
2004	854805	691107	163698	254955	232920	4.5117	34	4	22035	6.03946102	13	4	458187	141663
2005	978623	780010	198613	269068	248393	6.643053	32	4	20675	-6.1719991	10	3	531617	177938
2006	985612	796291	189321	259896	236366	-4.84206	30	4	23530	13.808948	12	4	559925	165791
2007	881616	685151	196465	271686	246532	4.301148	36	4	25154	6.90182745	13	4	438619	171311
2008	805281	601590	203692	283559	256699	4.123778	43	4	26860	6.78222152	13	4	344891	176832
2009	1037768	837626	200142	284655	266865	3.960458	32	4	17790	-33.767684	9	3	570761	182352
2010	875143	665453	209689	298848	277031	3.809581	42	4	21817	22.6363125	10	3	388422	187872
2011	1501306	1281985	219321	313126	287198	3.669778	22	4	25928	18.843104	12	4	994787	193393
2012	1141378	922766	218611	317062	297364	3.539872	32	5	19698	-24.028078	9	3	625402	198913
2013	921645	691733	229913	333010	307531	3.418849	44	5	25479	29.3481572	11	4	384202	204434
2014	999359	766711	232648	340391	317697	3.305828	41	5	22694	-10.93057	10	4	449014	209954
2015	1106948	866284	240664	353054	327864	3.20004	38	5	25190	10.9985018	10	4	538420	215474
2016	869715	629959	239756	356791	338030	3.100813	54	5	18761	-25.522033	8	3	291929	220995
2017	1248323	1003358	244964	366645	348196	3.007554	35	5	18449	-1.6630244	8	3	655162	226515
				6533059					626471					

Source: Authors' computation 2018 (computed from records from Nigerian Ports Authority and National Maritime Safety and Administration).

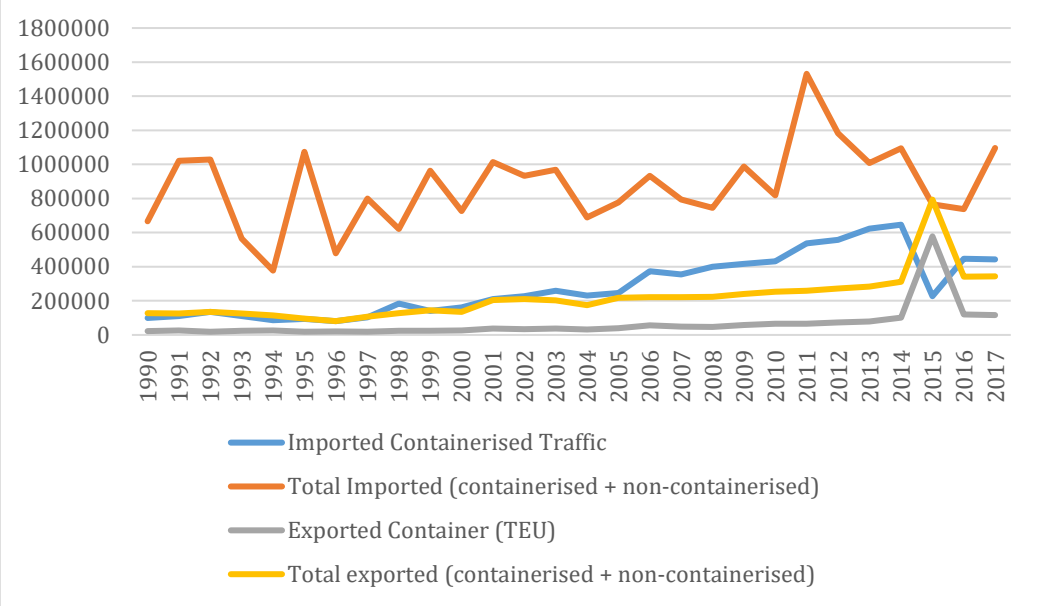
Table 2: Comparing import and export traffic

Year	Imported Container (TEU)	Exported Container (TEU)	Annual Flow
1990	100121	22980	-77141
1991	109848	26382	-83466
1992	134278	18513	-115765
1993	111564	23778	-87786
1994	85627	25673	-59954
1995	94580	18658	-75922
1996	80857	20946	-59911
1997	102660	18922	-83738
1998	183517	23939	-159578
1999	141594	23785	-117809
2000	161146	26212	-134934
2001	209634	37038	-172596
2002	227102	34103	-192999
2003	259055	36682	-222373
2004	230098	32087	-198011
2005	245773	39594	-206179
2006	373172	55933	-317239
2007	355551	49528	-306023
2008	400119	47197	-352922
2009	416351	57830	-358521
2010	430923	66289	-364634
2011	536719	66202	-470517
2012	556900	72774	-484126
2013	623409	78910	-544499
2014	646539	102102	-544437
2015	226826	578237	351411
2016	446645	121037	-325608
2017	442290	116319	-325971

Source: Authors' computation 2018 (computed from records from Nigerian Ports Authority and National Maritime Safety and Administration)

However, the container traffic flow for the exported goods from 1999 to 2017 fluctuated intermittently too (see table 1, the percentage change in exported containers). Table 2 showed that in 1990 Nigeria imported containerized goods five times more than what it exported while in 2017 it was 18 times more. The consequence of this is that container usage for import from other countries was very expensive because incoming containers were billed for the cost of inflow (loaded) and cost of outflow (for the anticipated unloaded containers). Importers of containerized goods were, therefore, paying for the cost of returning the empty containers thus it would be expected that the cost of using containers for exporting goods out of Nigeria will be cheaper.

Figure 1: Relationship between total throughput and imported containers



Time series analysis of container traffic

One of the best analytic methods in trend survey, which is often used for both explanatory as well as forecasting, is the trend decomposition using linear regression. Trend decomposition establishes the long-run general direction of the data over several years. This is done by using either a linear or quadratic regression model. A regression trend line can be fit to the data using the period as the independent variable. Linear regression has been adjusted to be better than the quadratic model in that it produces stronger and reliable regression parameters (Adkins & CarterHill, 2011). The procedure involved in time series trend regression analysis is to renumber the independent variable x, which represents the time and enter along with the dependent variable Y (Anyadike 2009: 328-330). The linear regression equation produces a trend line, which slope can be used for forecasting the future trend of the independent variable. The trend of container traffic of both import and export in Nigerian ports were examined in this section using the linear regression model for explanatory purpose only. The model is used to determine the general direction in container traffic in Nigeria. The linear regression was defined as:

$$Y=a+b_1x_1+e,$$

where Y = dependent variable (container traffic at Sampled port);
a = base constant;
b_1x_1 = regression co-efficient (Year when traffic was recorded);
E = error term.

In linear regression, the parameters which are important for the explanation of the trend include the regression coefficient b, the R values, including the R^2. While the regression co-efficient is used to assign the level of importance to the independent variable, the R^2 is to judge if the variables used to fit the models reasonably. Also, the F change or the probability value and significant level are most important to determine the reliability of the sample (Brooks, 2008; Schopohl, 2014).

Table 3: Regression analysis: Trend analysis of imported containers (trendline curve fit)

	r^2	0.940	n	28		
	r	0.969	k	1		
	Std. Error	21592.23	Dep. Var.	**Imported Container**		
ANOVA						
Source	*SS*	*df*	*MS*	*F*	*p-value*	
Regression	188,832,209,468.6	1	188,832,209,468.6	405.02	2.23E-17	
Residual	12,121,839,670.07	26	466,224,602.6953			
Total	200,954,049,138.7	27				
Regression output					*confidence interval*	
Variables	*coefficients*	*std. error*	*t (df=26)*	*p-value*	*95% lower*	*95% upper*
Intercept	73,702.6618					
t	10,166.4368	505.1593	20.125	2.23E-17	9,128.0670	11,204.80

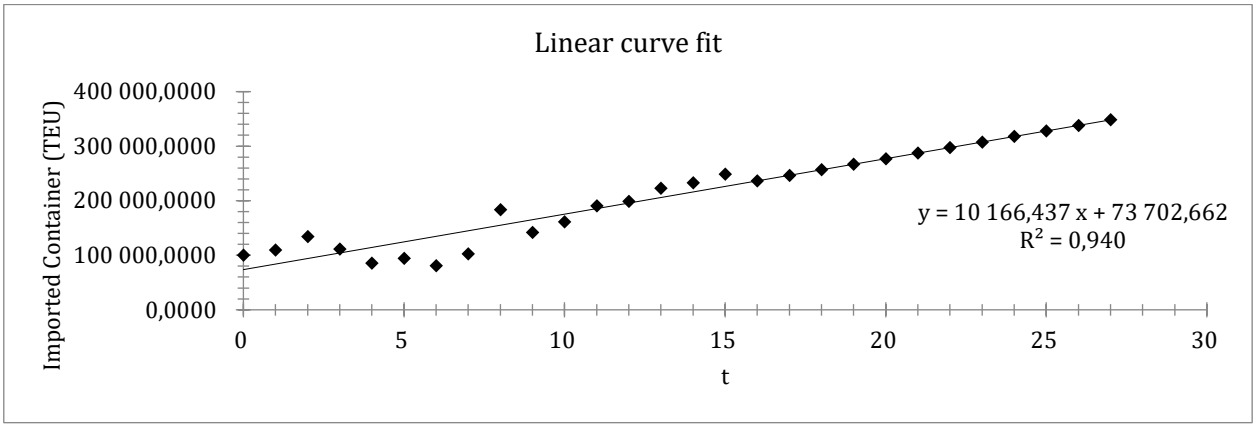
Source: Field Work, 2018

Tables 3, 4 and 5 show the results of the trend analysis of the container traffic imported into Nigeria from 1990 to 2017 and the predicted volumes for container traffic for the next forty years from 2018 to 2057. The R-squared was observed to be 94%, indicating that the model explains nearly all the variability of the response data around its mean. The *p-value* for the regression analysis (trend analysis) was well below the 0.05% significance level, meaning that differences between the mean are statistically significant (Table 3). This is further shown in Figure 2 – the linear curve fit, revealing that the economy of Nigeria will continue to grow with importation dominating the national trade of the national with across international borders, as seen in Table 4. The trend analysis shows that the Dubbin-Watson was equal to 1, (less than two but not less than 1) meaning that there is evidence of positive serial correlation and there is no cause for alarm as the value is exactly one (1) since less than one would have meant the successive errors terms are positively correlated.

Table 4: The trend of imported containers

t	Imported Container (TEU)	Predicted	Residual
1990	100,121.00000	73,702.66176	26,418.33824
1991	109,848.00000	83,869.09853	25,978.90147
1992	134,278.00000	94,035.53529	40,242.46471
1993	111,564.00000	104,201.97206	7,362.02794
1994	85,627.00000	114,368.40882	-28,741.40882
1995	94,580.00000	124,534.84559	-29,954.84559
1996	80,857.00000	134,701.28235	-53,844.28235
1997	102,660.00000	144,867.71912	-42,207.71912
1998	183,517.00000	155,034.15588	28,482.84412
1999	141,594.00000	165,200.59265	-23,606.59265
2000	161,146.00000	175,367.02941	-14,221.02941
2001	190,467.00000	185,533.46618	4,933.53382
2002	198,778.00000	195,699.90294	3,078.09706
2003	222,865.00000	205,866.33971	16,998.66029
2004	232,920.00000	216,032.77647	16,887.22353
2005	248,393.00000	226,199.21324	22,193.78676
2006	236,365.65000	236,365.65000	-0.00000
2007	246,532.08676	246,532.08676	0.00000
2008	256,698.52353	256,698.52353	0.00000
2009	266,864.96029	266,864.96029	0.00000
2010	277,031.39706	277,031.39706	0.00000
2011	287,197.83382	287,197.83382	0.00000
2012	297,364.27059	297,364.27059	-0.00000
2013	307,530.70735	307,530.70735	-0.00000
2014	317,697.14412	317,697.14412	-0.00000
2015	327,863.58088	327,863.58088	-0.00000
2016	338,030.01765	338,030.01765	0.00000
2018	348,196.45441	348,196.45441	0.00000

Figure 2: Linear curve fit for the trend analysis for imported container traffic in Nigeria (1999-2017)



Source: Field Work, 2018.

The volume of container traffic is expected to snowball as the economy of Nigeria keeps expanding. Table 5 shows that by the year 2058, the amount of export would have grown to about 470,194 TEUs with an expected population of 300 million as more than 85% of the Nigerian population would be in the age bracket of 18 – 45 years. This is good, but if Nigeria continues to be import-dependent, the export traffic will not grow as shown by the projected traffic for the exported container (see Table 6). Tables 6 shows the results of the regression analysis of the container traffic exported from Nigeria from 1990 to 2017 and the predicted volumes for container traffic that will be imported into Nigeria for the next forty years.

Table 5: Predicted values for Imported Container (TEU) for the net forty (40) years

Period = year		95% Confidence Intervals		95% Prediction Intervals	
t	Predicted	lower	upper	lower	upper
2018	73,703	57,366.89129	90,038.43224	26,408.36843	120,996.95510
2019	83,869	68,415.17046	99,323.02659	36,872.11270	130,866.08436
2020	94,036	79,442.83809	108,628.23250	47,314.66633	140,756.40426
2021	104,202	90,446.02228	117,957.92183	57,735.65158	150,668.29254
2022	114,368	101,419.97571	127,316.84194	68,134.71218	160,602.10546
2023	124,535	112,358.88117	136,710.81000	78,511.51570	170,558.17548
2024	134,701	123,255.64029	146,146.92441	88,865.75566	180,536.80904
2025	144,868	134,101.67257	155,633.76567	99,197.15373	190,538.28451
2026	155,034	144,886.78096	165,181.53080	109,505.46160	200,562.85016
2027	165,201	155,599.18125	174,802.00404	119,790.46288	210,610.72242
2028	175,367	166,225.83654	184,508.22228	130,051.97461	220,682.08422
2029	185,534	176,753.25337	194,313.67898	140,289.84871	230,777.08365
2030	195,700	187,168.82504	204,230.98084	150,503.97309	240,895.83279
2031	205,866	197,462.59848	214,270.08094	160,694.27255	251,038.40687
2032	216,033	207,629.03524	224,436.51770	170,860.70931	261,204.84363
2033	226,199	217,668.13534	234,730.29113	181,003.28339	271,395.14308
2034	236,366	227,585.43719	245,145.86281	191,122.03253	281,609.26747
2035	246,532	237,390.89389	255,673.27964	201,217.03196	291,847.14157
2036	256,699	247,097.11213	266,299.93492	211,288.39376	302,108.65330
2037	266,865	256,717.58537	277,012.33522	221,336.26602	312,393.65457
2038	277,031	266,265.35051	287,797.44361	231,360.83167	322,701.96245
2039	287,198	275,752.19176	298,643.47588	241,362.30713	333,033.36051
2040	297,364	285,188.30617	309,540.23500	251,340.94070	343,387.60048
2041	307,531	294,582.27424	320,479.14047	261,297.01071	353,764.40399
2042	317,697	303,941.19434	331,453.09389	271,230.82364	364,163.46460
2043	327,864	313,270.88368	342,456.27809	281,142.71192	374,584.44984
2044	338,030	322,576.08958	353,483.94571	291,033.03181	385,027.00348
2045	348,197	331,860.68394	364,532.22489	300,902.16108	395,490.74774
2046	358,363	341,127.83026	375,597.95209	310,750.49668	405,975.28567
2047	368,529	350,380.12201	386,678.53387	320,578.45245	416,480.20344
2049	378,696	359,619.69461	397,771.83480	330,386.45675	427,005.07266
2050	388,862	368,848.31508	408,876.08786	340,174.95023	437,549.45271
2051	399,029	378,067.45340	419,989.82307	349,944.38358	448,112.89289

2052	409,195	387,278.33905	431,111.81095	359,695.21541	458,694.93459
2053	419,362	396,482.00603	442,241.01750	369,427.91018	469,295.11335
2054	429,528	405,679.32856	453,376.56850	379,142.93628	479,912.96078
2055	439,694	414,871.04971	464,517.72087	388,840.76424	490,548.00635
2056	449,861	424,057.80426	475,663.83986	398,521.86499	501,199.77913
2057	460,027	433,240.13711	486,814.38054	408,186.70834	511,867.80931
2058	470,194	442,418.51827	497,968.87290	417,835.76152	522,551.62965

Source: Field Work, 2018

The R-squared was observed to be 0.005%, indicating that the model did not explain all the variability of the response data around its mean. The *p-value* for the regression analysis (trend analysis) was well above the 0.05% significance level was 71.21%, meaning that differences between the mean are not statistically significant. This is further shown in Figure 3 – the linear curve fit, revealing that the economy of Nigeria will continue to grow with importation dominating the national trade of the national with across our international borders, as seen in Table 5. From the trend analysis, it was observed that the Dubbin-Watson was equal to 1, (less than two but not less than 1) meaning that there is evidence of positive serial correlation and there is no cause for alarm as the value is exactly one (1) since less than one would have meant the successive errors terms are positively correlated.

Table 6: Regression Analysis: Trend Analysis of Exported Containers (Trendline Curve Fit)

	r^2	0.255	n	28
	r	0.505	k	1
	Std. Error	91998.882	Dep. Var.	**Exported Container (TEU)**

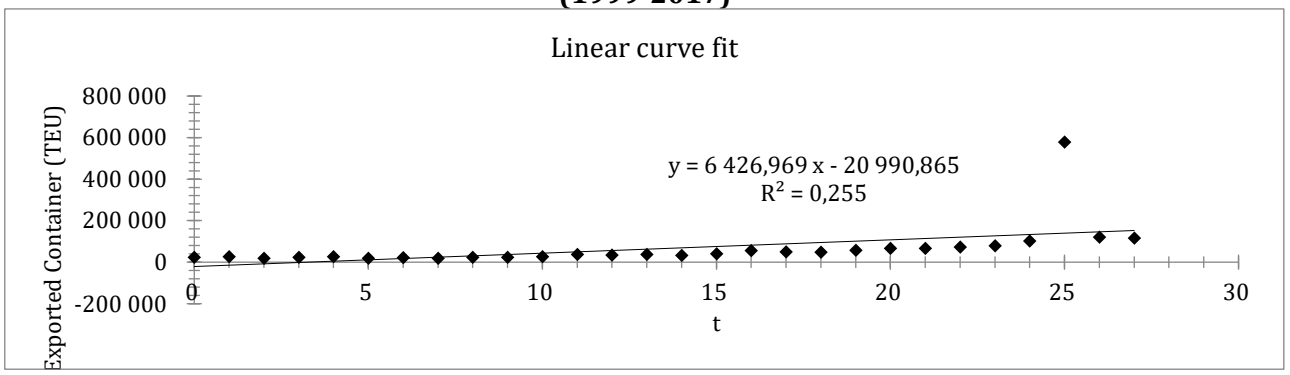
ANOVA table

Source	*SS*	*df*	*MS*	*F*	*p-value*
Regression	75,465,930,406.7783	1	75,465,930,406.7783	8.92	**.0061**
Residual	220,058,653,831.9360	26	8,463,794,378.1514		
Total	295,524,584,238.7140	27			

Regression output

					confidence interval	
Variables	*coefficients*	*std. error*	*t (df=26)*	*p-value*	*95% lower*	*95% upper*
Intercept	-20,990.8645	33,861.0858	-0.620	.5407	-90,593.3232	48,611.5941
t	6,426.9688	2,152.3519	2.986	**.0061**	2,002.7461	10,851.1915

Figure 3: Linear curve fit for the trend analysis for exported container traffic in Nigeria (1999-2017)



Source: Field Work, 2018

The projected export traffic is expected to be 21,977 TEUs by the year 2047 but the import will be 368,529 TEUs. This showed that if Nigeria continues to be a mono-economy that is import-oriented, its industrial output will not be enough to have what will be in excess for us to sell to other markets/economies. The objective of this chapter was to consider the spatial and temporal trend in container traffic of both inward and outward traffic. The analysis done was necessary to evaluate the change in traffic flow and to account for the variations over the years.

Table 7: Predicted values for Exported Container (TEU)

		95% Confidence Intervals		95% Prediction Intervals		
t	**Predicted**	**lower**	**upper**	**lower**	**upper**	**Leverage**
2018	22,719.5	20,497.7	24,941.4	16,287.1	29,152.0	0.135
2019	22,693.9	20,592.1	24,795.8	16,301.9	29,086.0	0.121
2020	22,668.3	20,683.6	24,653.1	16,313.8	29,022.8	0.108
2021	22,642.7	20,771.8	24,513.7	16,322.9	28,962.6	0.096
2022	22,617.1	20,856.0	24,378.3	16,328.9	28,905.4	0.085
2023	22,591.5	20,935.5	24,247.6	16,331.9	28,851.2	0.075
2024	22,565.9	21,009.2	24,122.7	16,331.9	28,800.0	0.067
2025	22,540.4	21,076.1	24,004.6	16,328.7	28,752.0	0.059
2026	22,514.8	21,134.6	23,894.9	16,322.4	28,707.1	0.052
2027	22,489.2	21,183.3	23,795.0	16,312.9	28,665.4	0.047
2028	22,463.6	21,220.3	23,706.8	16,300.3	28,626.8	0.042
2029	22,438.0	21,243.8	23,632.2	16,284.4	28,591.5	0.039
2030	22,412.4	21,252.1	23,572.7	16,265.3	28,559.4	0.037
2031	22,386.8	21,243.8	23,529.8	16,242.9	28,530.6	0.036
2032	22,361.2	21,218.2	23,504.2	16,217.3	28,505.0	0.036
2033	22,335.6	21,175.3	23,495.9	16,188.5	28,482.7	0.037
2034	22,310.0	21,115.8	23,504.2	16,156.4	28,463.5	0.039
2035	22,284.4	21,041.1	23,527.7	16,121.1	28,447.7	0.042
2036	22,258.8	20,952.9	23,564.7	16,082.6	28,435.0	0.047
2037	22,233.2	20,853.0	23,613.3	16,040.8	28,425.5	0.052
2038	22,207.6	20,743.3	23,671.9	15,995.9	28,419.2	0.059
2039	22,182.0	20,625.3	23,738.7	15,947.9	28,416.1	0.067
2040	22,156.4	20,500.3	23,812.4	15,896.8	28,416.0	0.075
2041	22,130.8	20,369.7	23,891.9	15,842.6	28,419.0	0.085
2042	22,105.2	20,234.2	23,976.1	15,785.3	28,425.1	0.096
2043	22,079.6	20,094.8	24,064.3	15,725.1	28,434.1	0.108
2044	22,054.0	19,952.1	24,155.9	15,661.9	28,446.0	0.121
2045	22,028.4	19,806.6	24,250.2	15,595.9	28,460.9	0.135
2046	22,002.8	19,658.7	24,346.9	15,527.0	28,478.5	**0.151**
2047	21,977.2	19,508.7	24,445.7	15,455.4	28,499.0	**0.167**

Source: Author's Computation, (2018)

Test of Hypotheses 1 and 2

Since the linear regression analysis was used to estimate the trend in the imported and exported containers, the Student's t-test version for linear regression test of significance was employed to test the two hypotheses. H1 states that *"there is no significant relationship between the total imported container traffic and year at 95% confidence level."* While H2 states that: *"there is no significant relationship between the total exported container traffic and year at 95% confidence level."* The data used are presented in Table 8, which contains the variables to see how each behaved with time from 1990 to 2017. The decision on accepting or rejecting the null hypothesis in linear regression analysis is dependent on the t-ratios and the p-values. Informally, to safely reject the null hypothesis, you generally look for t-ratios with magnitudes (absolute values) of 2 or higher. From the result of our analysis (Table 9), the regression coefficient for imported has a t-ratio of 20.125 and for export, a t-ratio of 2.986, which are both higher than 2.0. Formally, the p-values which tell the probability of obtaining the results if the null hypothesis is correct helps us make more precise inferences about the relationship between the year and the imported or exported container traffic. If the p-value is greater than 0.05, then the observed results would have occurred by chance, and hence we must accept the null hypothesis; otherwise, we reject the null hypothesis.

Table 8: Total imported/exported traffic and container

Year	TICN	IC (TEU)	TECN	EC (TEU)
1990	665770	100121	128459	22980
1991	1021178	109848	125868	26382
1992	1029821	134278	135467	18513
1993	566031	111564	126620	23778
1994	377293	85627	114143	25673
1995	1073932	94580	95474	18658
1996	478004	80857	80951	20946
1997	798933	102660	106900	18922
1998	620980	183517	127274	23939
1999	963187	141594	144890	23785
2000	727533	161146	136006	26212
2001	994116	190467	190531	22935
2002	904907	198778	195549	18908
2003	932569	222865	186558	20780
2004	691107	232920	163698	22035
2005	780010	248393	198613	20675
2006	796291	236366	189321	23530
2007	685151	246532	196465	25154
2008	601590	256699	203692	26860
2009	837626	266865	200142	17790
2010	665453	277031	209689	21817
2011	1281985	287198	219321	25928
2012	922766	297364	218611	19698
2013	691733	307531	229913	25479
2014	766711	317697	232648	22694
2015	866284	327864	240664	25190
2016	629959	338030	239756	18761
2017	1003358	348196	244964	18449

NB: TICN-Total imported (containerised + non-containerised); IC- Imported Container; TECN-Total exported (containerised + non-containerised); EC-Exported Container

Since the t-ratios in the results in Table 8 are greater than 2.0 and the p-values less than 0.05, we must reject the H1 and H2. Thus, we conclude that there is a significant relationship between the year and the imported container traffic and the exported container traffic in Nigeria. Hence, there is a statistically significant trend in the time series of imported and exported container traffic in Nigeria. It was observed that both imported and exported container traffic had a positive linear relationship with the year, indicating a positive trend in the time series. Figure 4.4 shows that the relationship between imported container traffic and the year has upward sloping gradients, indicating that total imported container increased with time while figure 5 shows the relationship between exported container traffic and year. It suggests that the total exported containers had a gradient that is almost parallel with the horizontal axis, revealing that over the years, Nigeria's exported containers were fluctuating about the same range.

Table 9: Test of significance of hypothesis one and hypothesis two

Hypothesi	Variables	Coefficient	SE	t (df=26)	p-value	Decision	Remark
H1	Intercept **imported**	73,702.66 10,166.44	505.16	20.125	**0.000**	**Reject H1**	**Significant**
H2	**Intercept** **Exported**	-20,990.87 6,426.97	2152.35	2.986	**0.0061**	**Reject H2**	**Significant**

Figure 4: Relationship between the year and total imported container traffic

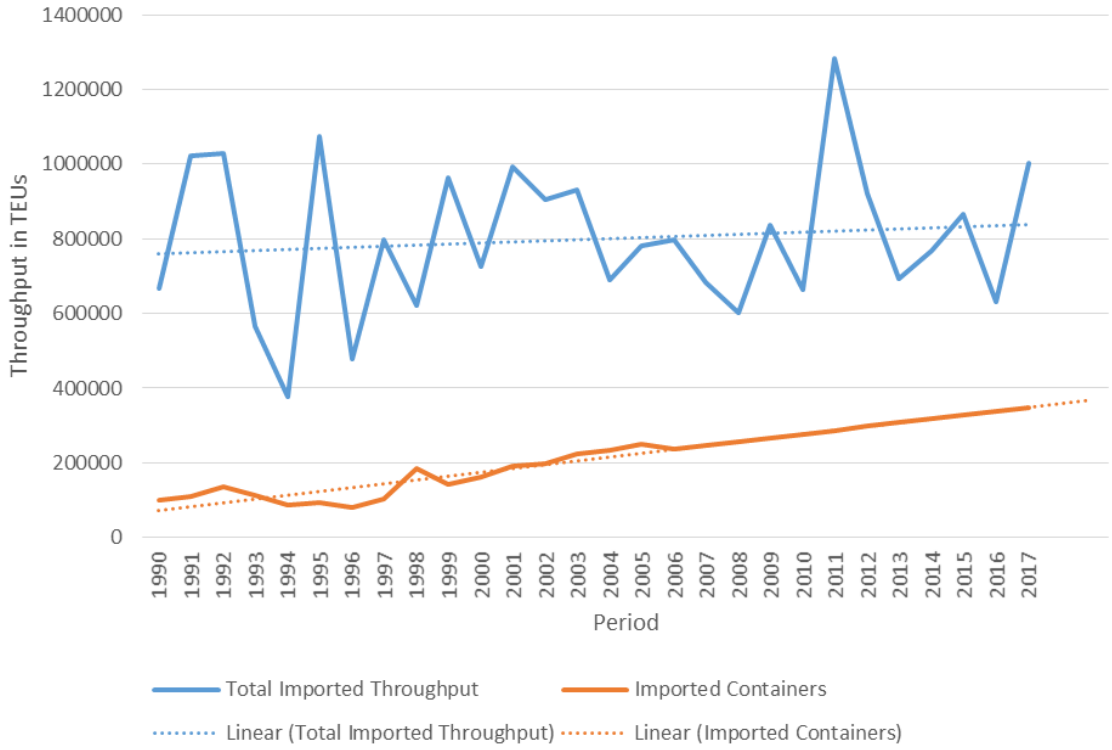
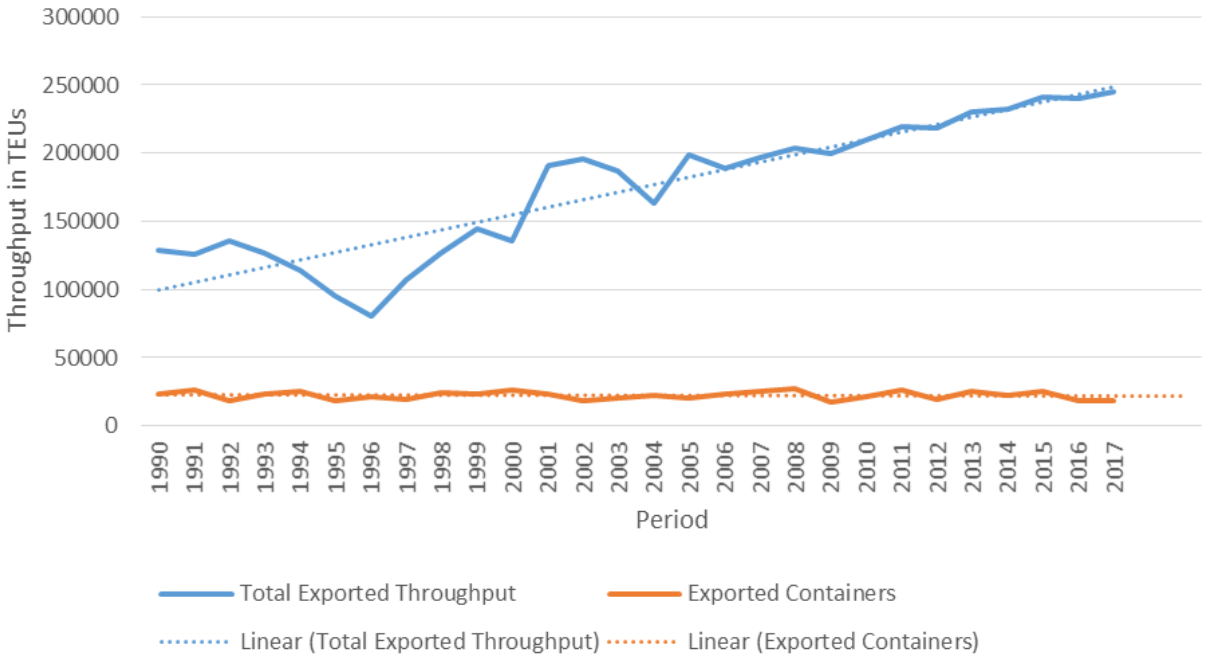


Figure 5: Relationship between the year and total exported container traffic



5. Conclusion

The critical finding revealed in this study is that Nigeria imported lots of commodities in containers than it exported because most of the country's exports are crude oil and non-containerized goods. This further explains the reason for the high costs of importation paid by the Nigerian shippers for imported containerized goods as shipping firms that are not sure of return loads for their containers and vessels make shippers pay for the "to" and 'from" Nigeria legs of the container movements. For those containers that were not paid for, they are stacked as empty containers awaiting usage out of Nigeria.

This means there are surplus containers in the land, and one expects a cheaper cost of container usage for export purposes. Nonetheless, the imported and exported container traffic both show a significant positive trend implying that containers flow into and out of Nigeria has had an upward trajectory since 1990. For the policymakers, this study helps in the planning of the operational decisions such as the port capacity utilization, equipment and handling of container activities and hinterland connections capacity provision. However, the decision to provide new capacities and investments in the port should be supported by growing potential demand. The consequences arising from an unnecessary investment decision or ineffective timing of the investment will be reflected in inefficient operation at the terminal and congestion that may result from under-capacity or extra unjustified cost of over-capacity, in case the potential demand is less than the planned supply

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