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
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 neighboring 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

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

(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 Container Traffic (TEU) | % Contributed for all throughputs on total container traffic from 1990 - 2017 | % Change in Imported Container | % Change in Exported Container |
|------|----------------------------------------|--------------------------------------------------|-------------------------------|--------------------------------------------------------------------------------|-------------------------------|--------------------------------|
| 1990 | 794229                                 | 665770                                           | 128459                        | 121310                                                                          | 15                            | 22980                           |
| 1991 | 1147046                                | 102178                                           | 125868                        | 136230                                                                          | 15                            | 26382                           |
| 1992 | 1165288                                | 102982                                           | 135467                        | 152791                                                                          | 13                            | 18513                           |
| 1993 | 692651                                 | 566031                                           | 126620                        | 135342                                                                          | 20                            | 23778                           |
| 1994 | 491436                                 | 377293                                           | 114143                        | 111300                                                                          | 23                            | 25673                           |
| 1995 | 1166486                                | 107932                                           | 112338                        | 94580                                                                           | 9                             | 18658                           |
| 1996 | 558955                                 | 478004                                           | 110803                        | 89511                                                                           | 17                            | 20946                           |
| 1997 | 905835                                 | 798933                                           | 112512                        | 102660                                                                          | 13                            | 18922                           |
| 1998 | 746788                                 | 620898                                           | 127274                        | 207456                                                                          | 30                            | 23939                           |
| 1999 | 1108077                                | 963187                                           | 144980                        | 165379                                                                          | 15                            | 23785                           |
| 2000 | 863539                                 | 727533                                           | 136066                        | 187358                                                                          | 22                            | 26212                           |
| 2001 | 1184647                                | 994116                                           | 213402                        | 190467                                                                          | 19                            | 22935                           |
| 2002 | 1108456                                | 904907                                           | 217686                        | 190778                                                                          | 32                            | 21817                           |
| 2003 | 1119127                                | 932569                                           | 243649                        | 228632                                                                          | 24                            | 20970                           |
| 2004 | 854805                                 | 691107                                           | 136398                        | 254955                                                                          | 34                            | 22035                           |
| 2005 | 979623                                 | 780810                                           | 269068                        | 248933                                                                          | 32                            | 26675                           |
| 2006 | 985612                                 | 796291                                           | 286996                        | 236366                                                                          | 36                            | 25530                           |
| 2007 | 881616                                 | 685151                                           | 194665                        | 246532                                                                          | 36                            | 25154                           |
| 2008 | 805281                                 | 601590                                           | 230692                        | 283559                                                                          | 43                            | 26860                           |
| 2009 | 1037766                                | 837626                                           | 284655                        | 266895                                                                          | 43                            | 17790                           |
| 2010 | 875143                                 | 665453                                           | 209689                        | 299848                                                                          | 32                            | 21817                           |
| 2011 | 1501306                                | 1281985                                          | 219321                        | 287701                                                                          | 22                            | 25928                           |
| 2012 | 114378                                 | 922766                                           | 218611                        | 297364                                                                          | 32                            | 19698                           |
| 2013 | 921645                                 | 691733                                           | 229913                        | 307531                                                                          | 45                            | 25479                           |
| 2014 | 999359                                 | 766711                                           | 232648                        | 340991                                                                          | 41                            | 26949                           |
| 2015 | 1106948                                | 866284                                           | 240666                        | 328766                                                                          | 38                            | 25190                           |
| 2016 | 869715                                 | 629959                                           | 239756                        | 356791                                                                          | 54                            | 18761                           |
| 2017 | 1248323                                | 1003358                                          | 244964                        | 366645                                                                          | 35                            | 18449                           |
| 2018 | 852959                                 | 623959                                           | 161319                        | 92774                                                                           | 18                            | 116319                          |

**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                    | -43366      |
| 1992 | 134278                   | 18573                    | -11575      |
| 1993 | 111564                   | 23778                    | -87876      |
| 1994 | 85627                    | 25673                    | -59545      |
| 1995 | 94580                    | 18658                    | -59911      |
| 1996 | 80857                    | 20946                    | -83738      |
| 1997 | 102660                   | 18922                    | -83738      |
| 1998 | 183517                   | 23939                    | -155978     |
| 1999 | 141594                   | 23785                    | -117009     |
| 2000 | 161146                   | 26212                    | -134934     |
| 2001 | 209634                   | 37038                    | -172596     |
| 2002 | 227102                   | 34103                    | -192999     |
| 2003 | 250555                   | 36682                    | -222737     |
| 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                    | -36463      |
| 2011 | 536719                   | 66202                    | -470517     |
| 2012 | 556900                   | 72774                    | -484126     |
| 2013 | 623409                   | 78910                    | -544499     |
| 2014 | 645639                   | 102102                   | -544437     |
| 2015 | 257023                   | 257023                   | 0           |
| 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](image)

**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:

\[
Y = a + b_1x + e,
\]

where \( Y \) = dependent variable (container traffic at Sampled port);

- \( a \) = base constant;
- \( b_1x \) = 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)

| r²   | 0.940 | n   | 28 |
|------|-------|-----|----|
| r    | 0.969 | k   | 1  |
| Std. Error | 21592.23 | Dep. Var. | Imported Container |

| Source | SS     | df | MS    | F   | p-value   |
|--------|--------|----|-------|-----|-----------|
| Regression | 188,832,209,468.6 | 28 | 6,954,412,024.6 | 405.02 | 2.23E-17 |
| Residual | 12,121,839,670.07 | 1  | 466,224,602.6953 |     |           |
| Total   | 200,954,049,138.7 | 29 |       |     |           |

Regression output

| Variables | coefficients | std. error | t (df=26) | p-value 95% lower | 95% upper |
|-----------|--------------|------------|-----------|-------------------|-----------|
| Intercept | 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            | 246,236.65000 | -0.00000 |
| 2007| 246,532.08676            | 256,698.52353 | 0.00000 |
| 2008| 256,698.52353            | 266,864.96029 | 0.00000 |
| 2009| 266,864.96029            | 277,031.39706 | 0.00000 |
| 2010| 277,031.39706            | 287,197.83382 | 0.00000 |
| 2011| 287,197.83382            | 297,364.27059 | 0.00000 |
| 2012| 297,364.27059            | 307,530.70735 | 0.00000 |
| 2013| 307,530.70735            | 317,697.14412 | 0.00000 |
| 2014| 317,697.14412            | 327,863.58088 | 0.00000 |
| 2015| 327,863.58088            | 338,030.01765 | 0.00000 |
| 2016| 338,030.01765            | 348,196.45441 | 0.00000 |
| 2017| 348,196.45441            | 358,462.89118 | 0.00000 |

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 | Predicted 95% Confidence Intervals | 95% Prediction Intervals |
|--------------|-----------------------------------|-------------------------|
| t            | lower    | upper    | lower    | upper    |
| 2018         | 73,703   | 57,366.89129 | 90,038.43224 | 26,408.36043 | 120,996.95510 |
| 2019         | 83,869   | 68,415.17046 | 99,323.02659 | 36,872.11270 | 130,866.8436 |
| 2020         | 94,036   | 79,442.83809 | 108,628.23250 | 47,314.66633 | 140,756.40426 |
| 2021         | 104,202  | 90,464.02228 | 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 | 88,657.75566 | 180,536.80904 |
| 2025         | 144,868  | 134,101.67257 | 155,633.76567 | 99,197.15373 | 190,539.82451 |
| 2026         | 155,034  | 144,886.78096 | 165,181.53080 | 109,905.46160 | 200,562.85016 |
| 2027         | 165,201  | 155,599.18128 | 174,802.00404 | 119,790.46289 | 210,630.72242 |
| 2028         | 175,367  | 166,225.83654 | 184,508.22228 | 130,051.97461 | 220,682.09422 |
| 2029         | 185,534  | 176,753.25337 | 194,313.67898 | 140,289.84871 | 230,777.83655 |
| 2030         | 195,700  | 187,168.82504 | 204,230.98084 | 150,503.97309 | 240,895.83279 |
| 2031         | 205,866  | 197,462.59480 | 214,270.08094 | 160,694.27255 | 250,138.04687 |
| 2032         | 216,030  | 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 | 302,108.6533 |
| 2037         | 266,865  | 256,717.58537 | 277,012.35322 | 221,336.66023 | 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 | 333,033.6051 |
| 2040         | 297,364  | 285,188.30617 | 309,540.23500 | 251,349.90470 | 343,387.60048 |
| 2041         | 307,531  | 294,502.27424 | 320,479.14047 | 261,297.01071 | 353,764.40399 |
| 2042         | 317,697  | 303,941.19434 | 331,453.09389 | 271,230.82364 | 364,163.4646 |
| 2043         | 327,864  | 313,270.88368 | 342,456.27809 | 281,142.71192 | 374,584.4948 |
| 2044         | 338,030  | 322,576.08958 | 353,483.94571 | 291,030.03181 | 385,027.0348 |
| 2045         | 348,197  | 331,860.68394 | 364,532.22489 | 300,902.16108 | 395,490.74774 |
| 2046         | 358,363  | 341,127.83026 | 375,597.92050 | 310,750.49668 | 405,975.28567 |
| 2047         | 368,529  | 350,380.12200 | 386,678.53387 | 320,578.42545 | 416,480.20344 |
| 2048         | 378,696  | 359,619.69461 | 397,717.83480 | 330,386.45675 | 427,005.7266 |
| 2049         | 388,862  | 368,848.31508 | 408,876.08786 | 340,174.95023 | 437,549.45271 |
| 2050         | 399,029  | 378,867.45340 | 419,989.23207 | 349,944.38358 | 448,112.89289 |

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

Source: Field Work, 2018.

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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.
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 | 1277274 | 23939 |
| 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 | 994116 | 190467 | 190531 | 22935 |
| 2000 | 904907 | 198778 | 195531 | 20946 |
| 2001 | 780010 | 248393 | 198613 | 20675 |
| 2002 | 796291 | 236366 | 189321 | 23939 |
| 2003 | 685151 | 246532 | 196465 | 25154 |
| 2004 | 601590 | 256699 | 203692 | 26860 |
| 2005 | 837626 | 266665 | 200142 | 17790 |
| 2010 | 665453 | 277031 | 209689 | 21817 |
| 2011 | 321995 | 287198 | 219321 | 25928 |
| 2012 | 922766 | 297364 | 218611 | 19698 |
| 2013 | 691733 | 307531 | 229913 | 25479 |
| 2014 | 767611 | 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

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