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Impact Of Port Congestion On Nigeria Economic Growth: An Ardl Approach

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ABSTRACT
The study investigates the impact of port congestion on economic growth in Nigeria using the Autoregressive Distributed Lag (ARDL) approach to cointegration and error correction modelling to analyze time series data from 1995 to 2019. The study finds the existence of a long run relationship among the variables and that Cargo Throughput (CTP), Ship Turnaround Time (STT) and Port Infrastructural Development (PID) which are the independent variables employed in the study showed positive but insignificant relationship with the dependent variable RGDP indicating that benefits imbedded in the ports in Nigeria is not harnessed, primarily due to the over dependence on crude oil export as the main source of foreign exchange earnings. The short run dynamic ECM is negative and statistically significant indicating that port congestion in Nigeria is a short run problem, though it can be corrected in the long run if the government can make deliberate effort in putting the necessary infrastructures in place. The study therefore recommends that government should make conscious effort to invest more in the ports through needed infrastructures in order to harness the gains from an efficient port. The ARDL model used in the study is also stable based on the CUSUM and CUSUMQ Test.
Keywords: Congestion, Ports, Economic Growth, Autoregressive Distributed Lag (ARDL)

INTRODUCTION

Ports which are integral part of the maritime sector, are widely recognized as crucial nodes in international trade and transport. However, for various reasons, capacity does not always match demand: sometimes there is overcapacity, whereas in other cases, demand exceeds capacity and there is a shortage of the latter, (Hilde Meersman, Eddy Van de Voorde and Thierry Vanelslander, 2012). Port congestion is one of the serious problems of many ports around the world. This problem hinders efficient trade facilitation and economic development. The world economy continues to be the driving force behind the maritime sector. The huge volume of maritime trade occasioned by the world economic growth is also a contributing factor (Hilde Meersman, et. al., 2010). However, because of the increase of international trade, ships are bigger in size and volume, which pose new challenges to many ports around the world as many ports were not developed to handle and store a lot of cargo at the port area and the supporting infrastructure such as rail and road are not able to meet the required demand of timely cargo handling. Port congestion will have a detrimental impact on the generalized cost and on the overall transport or throughput performance which therefore impact on the growth of the economy.

Nigeria's strategic location in Africa puts her at advantage in becoming the hub of shipping activities. As a coastal state, with extensive coastline and vast exclusive economic zone, the inland waterways and large volume of various commodities especially oil and gas exports, should make our seaports beehives of economic activities. According to (Onyema, Obinna, Emenyonu, and Emeghara, 2015), the Maritime sector is recognized as the catalyst for national development, as it houses most critical infrastructure and also a value creating hub for the national economy. The need to develop its

potential into national economic strength is germane to achieve sustainable economic development. The maritime sector is of critical significance to the Nigerian economy. Port congestion was noticed for the first time in Nigeria port in the early 1970's otherwise known as the era of cement armada. Ships were even reported to have waited for 10 months or an average of 240 days at our premier port of Apapa Lagos before gaining access for an allocated berth. Such situation has led to the bunching of vessels with significant threat to productivity and competiveness of the port's system (Ndikom, 2005). Port congestion and delay in freight handling has an adverse effect on the operational performance of Nigeria's ports. These stagnation in port activities has made the Nigerian ports operationally inefficient which in turn has resulted to longer dwell time of cargo in the ports, poor ship turn-round time, block stacking of containers, higher demurrage on importers, higher operating cost of vessels by shipping companies, inadequate berth and space utilization etc. The economic implications of these are, shippers now divert traffic (capital flight) to ports in neighbouring countries. These cargoes meant for Nigerian ports, always finds its way through smugglers into Nigerian borders (Onyema et. al., 2015). This trend if left unchecked will have an adverse effect on the Nigeria economy. According to Tongzon (2005), the efficiency of a port is crucial in the nation in order to achieve competitive advantages, it is expressed by way of providing good services that are expected by the customer and shipowners. Although, several studies have looked at the issue of port congestion in Nigeria but only Onyema et al., investigated its impact on the economy. This study therefore aims to unravel the impact of port congestion on the economic growth in Nigeria and suggest sustainable solutions for addressing the problem. This will be done by expanding the number of years to be investigated in the study as well as the use robust econometrics analysis hence addressing the lacuna in previous studies. The remaining parts of the study is presented in the following arrangement; literature review, methodology, data analysis, results and discussion of findings.

The Concept of Port Congestion

Port Congestion is a situation where ships on entrance use more time on the channel while waiting to berth (Somuyiwa et al., (2015). Ships queue more at the channels and the outside bar waiting to get space into the terminal for berth. The waiting time is calculated using service time of the vessels which is one way of measuring port efficiency. This is caused by the fact that there is more arrival of cargo than the ability of port to handle, store and remove them from port space. Maduka (2004) defined Port Congestion as massive un-cleared Cargo in the Port, resulting in delay of ships in the seaport. According to him, this occurs when ships spend longer time at berth than usual before being worked on or before berth. Congestion implies loss of time and money, and therefore undermines the competitive position of ports and maritime logistics chains. Consequently, maximum efforts must be made to avoid such maritime congestion. To this end, insight is required into present and future developments in maritime transport and port throughput, as well as into the strategic behaviour of the various market players involved. With respect to that behaviour, it is clear that shipping companies opt for ports with sufficient available capacity. This avoids the risk that the huge amount of capital, which is embedded in their vessels, get used sub-optimally. Available capacity implies not only berths, but also efficient terminal operations and good hinterland connections. It is up to all actors involved in terminal and hinterland operations to safeguard the provision of sufficient free capacity, (Hilde Meersman et. al., 2012). Since the port and maritime sector evolve very quickly and are facing a number of challenges; each of those developments will have consequences in terms of capacity utilisation and will therefore possibly relate to port congestion. Port congestion is a problem that affects efficiency levels, performance and productivity of seaports. It is therefore useful from an economic point of view as well as with an eye on policy-making and operational port management devoid of congestion in its many facet.

Empirical Review

Nze and Onyemechi (2018), carried out a research on five African ports to identify the active factors that cause port congestion in African ports. Their finding revealed that the bane of congestion in African ports emanates entirely from either planning, regulation, capacity, efficiency or a combination of these hence there is the need to improve the regulatory mechanism in African ports to curtail congestion. Also the study showed that there exist a significant relationship between cargo throughput and other port performance indicators in Nigeria during the study period.

Onyema et al., (2015) found a strong statistical and significant relationship between the independent variables and GDP (economic growth).They therefore opined that the Maritime sector is recognized as the catalyst for national development, as it houses most critical infrastructure and also a value creating hub for the national economy hence the gate operating hour be expanded.

Oyatoye, Adebiyi, Okoye and Amole (2011), used Queuing theory to address the problem of port congestion in Nigeria. The theory was used to predict the average arrival rate of ships to the Tin Can Island Port and the average service rate per ship in a month. They found out the number of berth in Nigeria port is adequate for the traffic intensity of vessels but other factors leading to port congestion were identified through the content analysis of the interview conducted with stakeholders at the port thus they recommended policies that could make Nigerian ports to be cost effective, more attractive and enhance quick turnaround of vessels at the ports.

Ahmodu et al., (2021) in their study the development of port infrastructure and service quality in the Nigerian ports found that the quality of port infrastructural has a negative and significant relationship with both ship turnaround time and average time spent at berth (service quality in the Nigerian ports). They opined that Nigeria ports should increase her investments in port infrastructure development in order to provide quality and efficient service to ports users.

Usman (2015), examined the common port congestion scenarios, their dimensions and the various factors that trigger congestion in the ports of Lagos, Durban, Mombasa and the catchment ports of the Suez canal by applying the concept of variations in turn-around time of ships and cargo vis-à-vis the port's capacity and relative efficiency level in order to identify the active factors that cause port congestion in African ports. His findings revealed that the bane of congestion in African ports emanates entirely from either planning, Regulation, capacity, efficiency or a combination of these. He therefore recommends that African ports should enhance their regulatory mechanisms and also improve capacity and efficiency level in order to shoulder the ever increasing challenges of port congestion in years ahead.

Ahmodu and Okeudo (2021), examined infrastructural development and service quality in the Nigerian ports using quantitative estimation by applying the Ordinary Least Square (OLS) multiple regression analysis on quality of port infrastructure index, linear shipping connectivity, logistic performance index and cargoes dwell time. Quality of port infrastructural index has a significant effect on cargoes dwell time (service quality in the Nigerian ports). Also, both liner shipping connectivity and logistics performance indexes were indirectly related to cargoes dwell time (service quality of the Nigerian ports). Based on the findings, they recommended amongst other things that, Nigeria ports should improve her shipping connectivity and logistic performance to avoid running the risk of losing same to other regional ports. Also, investments in port infrastructure development should be done under the public private partnership.

MATERIALS AND METHODS

This study investigates the impact of port congestion on Nigeria economic growth. The study adopts the ex-post facto research design since it relies on already existing data on the Nigerian economy and the maritime sector. The study used data covering a period of twenty-five (25) years that is from 1995-2019 which were sourced from the Annual operational statistics of the Nigeria Ports Authority (NPA), Central Bank of Nigeria (CBN) and the World Bank's data base. The variables used in this study includes; Cargo Throughput, Gross Domestic Product, Ship Turnaround Time (proxy for port congestion) and Port Infrastructural development. The variables used in the study are given in their annual growth rates.

The study used the Autoregressive Distributed Lag (ARDL)-Bound Test to cointegration proposed by Pesaran and Shin (1995) and Pesaran et al (1996b) and the Error correction modelling approach to investigate the short run and long run impact of the independent variables on the dependent variable. The ARDL modelling approach has a number of advantages among which are that it can be applied to data series that are of mixed order of integration and it's quite efficient for small and finite sample size. It also produces unbiased long run estimates. This methodology distinguishes this study from previous studies.

The generalized ARDL (p, q) model is specified as:

$$Y_t = \alpha + \sum_{i=1}^{p} \delta_i Y_{t-1} + \sum_{i=0}^{q} \beta_i' X_{t-1} + \varepsilon_{it}$$

A convention ECM for cointegrated data is in the form:
$\Delta RGDP = \beta_0 + \beta_1 \Delta RGDP(-1) + \beta_2 \Delta CTP + \beta_3 \Delta STT + \beta_4 \Delta PID + + \beta_7 ECM(-1) + \varepsilon_1$
Where; RGDP is Real Gross Domestic Product, CTP is Cargo Throughput, STT is Ship Turnaround Time, PID is Port Infrastructural Development and μ is the error term. All the independent variables are expected to have a positive impact with RGDP except STT. ECM is the OLS residual series from the long run cointegrating regression.

RESULTS AND DISCUSION

Unit Root Test

The results of the study is presented below. First we looked at the unit root test of the data shown in table 1 below. Since we are dealing with time series data it is necessary to conduct a unit root test to ascertain if the data are stationary or non-stationary in order to avoid spurious regression.

Table 1: ADF Unit Root Test Result

Variables	ADF Test Statistics	5 % Critical Values	Order of Integration	Remark
RGDP	-10.22847	-3.004861	I(1)	Stationary
CTP	-3.182664	-3.012363	I(1)	Stationary
STT	-5.767417	-3.052169	I(0)	Stationary
PID	-3.125471	-3.175352	I(1)	Stationary

Source: Author's Computation with EVIEWS 10

From the table above it can be observed that the variables used in the study are integrated at order one and level. While RGDP, CTP, and PID are integrated at order one, STT is integrated at levels. The outcome from the unit root test makes the ARDL the best technique for analysis, this is so since there's mixed order of integration. The next step is to check for the existence of long run relationship among the variables.

Cointegration Test

The ARDL-bound test approach to cointegration will be applied, because the Johassen cointegration cannot be applied in this case, due to the mixed order of integration. The bound test approach makes it possible to test for the existence of long run relationship among the variables by conducting an F-test for the joint significance of the coefficients of the lagged levels of the variables.

Table 2: Bound Test for Cointegration

Null hypothesis: No longrun Relationship Exist		
Test Statistic	**Value**	**K***
F-statistic	3.6603	3
Critical Value Bounds		
Significance	Lower	Upper
10%	2.37	3.2
5%	2.79	3.67
2.50%	3.15	4.08
1%	3.65	4.66

Source: Author's Computation with EVIEWS 10

From table 2 above, we reject the null hypothesis of no cointegration between the dependent and dependent variables since the computed F statistic (3.6603) is greater than the upper bound at the 10% significance level (3.2). Thus we can infer that there exist a long run relationship among RGDP, CPT, PID and STT. The series can there be combined in a linear fashion as shocks in the short run

experienced by individual series can be corrected in the long run. That is there will be convergence. We therefore proceed to estimate both the long run and short run model using the ARDL approach. The results are presented below.

Table 3: Long run Model Result

Dependent Variable: RGDP				
Long run Coefficients				
Variable	**Coefficient**	**Std. Error**	**t-Statistic**	**Prob.**
Constant	0.105951	0.084874	1.248331	0.2520
RGDP(-1)	0.152003	0.680845	0.223256	0.8297
CTP(-1)	0.157086	0.30976	0.507121	0.6277
PID(-1)	0.037047	0.280839	0.131917	0.8988
STT(-1)	0.089993	0.084098	1.070097	0.3201

Source: Author's Computation with EVIEWS 10

Table 3 above shows the long run model. There is a long run relationship among the dependent and independent variables, the estimated coefficients are positive though none is statistically significant indicating that port congestion is a short run phenomenon.

Table 4: Short run Model Result

Dependent Variable: D(RGDP)				
Short run Coefficients				
Variable	**Coefficient**	**Std. Error**	**t-Statistic**	**Prob.**
Constant	-0.004989	0.010785	-0.462625	0.6631
D(RGDP(-1))	0.127092	0.407105	0.312185	0.7675
D(CTP(-1))	0.158431	0.159012	0.996346	0.3648
D(PID(-1))	0.357365	0.234202	1.525884	0.1876
D(STT(-1))	0.009343	0.060339	0.154836	0.883
ECM(-1)	-1.454841	0.510902	-2.847592	0.0359
R-squared	0.76			
Durbin-Watson stat	1.92			

Source: Author's Computation with EVIEWS 10

The estimated coefficients of the short run dynamic Error Correction Model (ECM) is presented in table 4. The result showed that the error correction model is negative and statistically significant at the 5% level signifying a high speed of adjustment after a shock. Thus the problem of port congestion is a short run problem and can be effectively corrected in the long run with the needed port infrastructures in place as well as good policies that are efficiently implemented. The R-squared indicates that the ARDL Model explains up 76% of the variations in the dependent variable. Durbin-Watson stat of 1.92 shows that the model is free from autocorrelation. This further reveals that the model is not spurious since Durbin-Watson is greater than R-squared.

Diagnostics Test

We proceed to conduct some diagnostics test on the model;

Table 5: Breusch-Godfrey Serial Correlation LM Test

F-statistic	0.00125	Prob. F(1,4)	0.9735
Obs*R-squared	0.003436	Prob. Chi-Square(1)	0.9533

Source: Author's Computation with EVIEWS 10

The result of the Breusch-Godfrey Serial Correlation LM Test shows that the model does not suffer from heteroskedasticity given the probability value hence the model is homoskedastic.

The stability of the model was also tested using the cumulative sum of recursive residuals (CUSUM) and CUSUM of recursive squares (CUSUMQ). The results are presented in figure 1 and figure 2 below. From the result we fail to reject the null hypothesis at the 5% significance level since the plot lies comfortably within the 5% significance boundary. We can therefore infer that the ARDL model is stable.

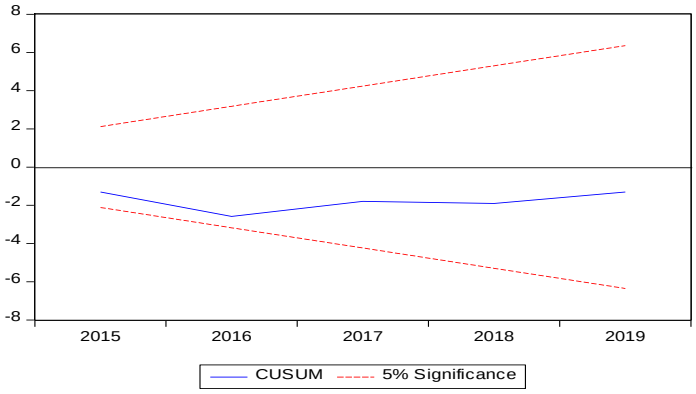

Figure 1: CUSUM

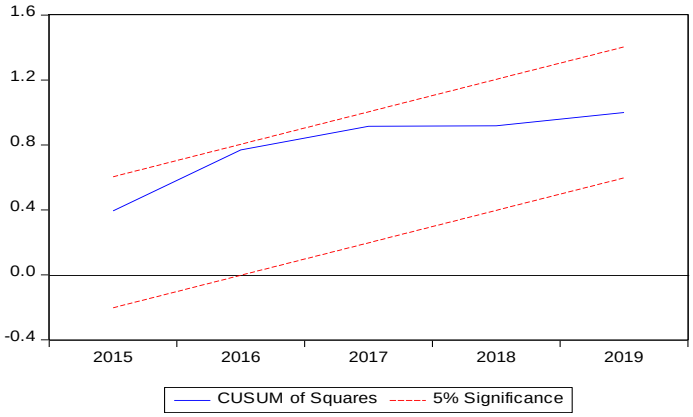

Figure 2: CUSUMQ Test

CONCLUSION AND RECOMMENDATIONS

The study investigate the impact of port congestion on economic growth in Nigeria using the Autoregressive Distributed Lag (ARDL) modelling approach with time series data of 25 years from 1995 to 2019. Cargo Throughput (CTP), Ship Turnaround Time (STT) and Port Infrastructural Development (PID) which are the independent variables employed in the study showed positive but insignificant relationship with the dependent variable RGDP. The dynamic error correction model which is negative and statistically significant reveals that port congestion in Nigeria is a short run problem, though it can be corrected in the long run if the government can make deliberate effort in putting the necessary infrastructures in place. This will help in improving ship turnaround time therefore reducing congestion in the ports. The lack of significance of the independent variable measuring the level of port congestion on economic growth in Nigeria, indicates that the benefits imbedded in the ports in Nigeria is not harnessed this is primarily due to the over dependence on crude oil export as the main source of foreign exchange earnings. Based on the empirical findings from the study, it is recommended that government should make conscious effort to invest more in the ports through needed infrastructures and harnessed the gains in an efficient port.

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