The Role of Port Infrastructural Quality on GDP Per Capital in West African Countries: A Static Model Approach

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Abstract

This study seeks to examine the effect of quality Port Infrastructure on growth using panel data of 15 West African countries. This study employed the random effect model and vector autoregressive model for the period 2006 to 2019. The result of the study revealed that air transportation posits a negative and significant effect on GDP per capital. Infrastructural quality of port had a positive and significant effect on GDP per capital. However, working poverty had a negative and significant impact on GDP per capital in West African countries. On the causality relationship, air transport freight does not granger causes GDP per capital. Quality of port infrastructure and GDP per capital has a bi-directional relationship. There is also a bi-directional relationship between Inflation and GDP per capital. Similarly, a bi-directional relationship also exists between working poverty and GDP per capital.

Keywords: Port Infrastructure, Air Transport, GDP Per capital, Working Poverty

JEL Classification: H54

1. Introduction

The sub-Sahara Africa received the highest number of transport commitments in 2016 ($6.6 billion or 26.9 percent of the total), as such it is expected that this policy response blend with increased GDP per capital in the region. West African markets remain one of the largest markets for commodity goods hitherto, records the lowest air transport services world over. This assertion reflects its poor income and inadequate air transport infrastructure hence has continued to reduce growth prospects. For instance, It is shocking that the region accounted for 4.1% of the total world passengertraffic in year 2002 and just 1.6% of the world air cargo traffic (See Oxford Economic Forecasting, 2003).

The West Africa's inflationary pressure was at the highest inthe year 2018 across all the sub regions, it stood at 13.4 percent but remained static. In the same year, Nigeria recorded (16.2%), Sierra Leone (11.7%), Liberia (11.2%) and, Ghana (8.3%). The inflation rate was driven by poor harvest in the Sahel region that led to an increase in food prices, higher import prices and an increase in production costs. In 2019 and 2020, inflation is expected to decrease, but still maintain its double digits.

Infrastructure such as airports and air-traffic management - is essential to the growth and functioning of air transport services. In many African countries, more than elsewhere in the world, infrastructure inefficiencies coupled with limited competition are making market access both difficult and expensive. In addition, safety issues are a source of concern, particularly given the prospective growth in demand for air services (Oxford Economic Forecasting, 2003). Improvements in the air transport infrastructure have a key role to play as a facilitator of and complement to policies that aim to improve living standards and alleviate poverty. The poor Infrastructure continued to deplete possible sustainability of good functioning port Infrastructure in the region. Even with the regional dependence on primary commodities, exchange rates remained stable to certain extent in several francophone countries, cushioned by an appreciating euro that continued in 2019.

In Nigeria, exchange rates remained stable with stronger oil prices in year 2018, but sensitive to political events in the country (African economic outlook, 2018). Following the uncertainty and poor conditions of port Infrastructure in the region, it is on this note that this study intends to investigate the effect of quality infrastructure of port on economic growth in West African countries.

2. Literature Review

Sharapiyeva, Antoni and Yessenzhigitova (2019) estimated the effect of quality of the port infrastructure on economic growth using sample of 37 landlocked employing the Structural Equation Model (SEM). Result of the study showed that quality port infrastructure indicated a positive and significant effect on economic growth.Ola (2018) in a study examined the impact of transportation on economic growth using data on Nigeria spanning from the period 1985 to 2010 and applying the Ordinary and Least Square (OLS). The result of the study revealed a positive relationship between transportation and economic development in Nigeria.

GizemAkbulut (2015) employed the panel data analysis using 26 sub-regions at NUTS 2 level in Turkey for the period between 2004 and 2011 to explore the nexus between air transport and economic growth, using Turkey as a case study and applying the least square method, fixed effect, 2SLS and GMM. Results of the study showed increasing number of active airports and its traffic frequency has a positive effect on regional economic growth. Munim and Schramm (2018) examined the effect of port infrastructure and logistic on economic growth using the structural equation model (SEM) on 91 countries, result shows a positive relationship between port infrastructure and logistic on economic growth.

Artar,Uca, and Taşçi (2016) explored the effect of air freight transport on economic growth using data on Turkey as well as USA and EU for the period 1980-2014 applying Ordinary Least Square regression and generalized method of moment. The result of study revealed that freight transport has a positive relationship with GDP.Ishutkina and Hansman (2009) in their study investigated the Interaction between Air Transportation and Economic Activity using 139 countries for the period 1975 to 2005 applying system GMM. Result of the study shows a positive relationship between air transport and GDP.

Stevans and Sessions (2005) in their study on the relationship between working poverty and GDP, using Error Correction Model in US Data in the period 1980s economic expansion, they found that there is a significant long run relationship between working poverty and GDP per capital during the period.

Theoretical Framework
According to neo-classical theory, transport infrastructures are investment in port infrastructure which is assumed to be exogenous, investment improves the quality of port infrastructure (QPI). To better QPI such as modern technologies and equipment would facilitate the logistics performance (LP) of a country (that is, greater reliability, less damage, ability to track and trace shipments, timeliness of delivery etc.) thus, Improved QPI and LP would increase the local and global accessibility of a country, including opportunities to expand markets worldwide.

The realization of those opportunities can be expressed in the form of a country's total international trade (herein, seaborne trade). Gains from trade can be characterized by improved labor supply, expanded production, diffusion of innovation, competitive pressures, economic restructuring, etc., leading to total factor productivity and GDP growth.

3. Methodology
This study covers 15 West African countries spanning the period 2006 to 2019 the rationale of employing this data sample is due to availability of data inform of non-probability sampling technique. The data are sourced from the World Development indicators. For instance, GDP per capita (current US$): GDP per capita is gross domestic product divided by midyear population. GDP is the sum of gross value added by all resident producers in the economy plus any product taxes, minus any subsidies not included in the value of the products. It is calculated without making deductions for depreciation of fabricated assets or for depletion and degradation of natural resources. Data are in current U.S. dollars (WDI, 2019Air transport is measured as freight (million ton-km) (WDI, 2019)Quality of port infrastructure, WEF (1=extremely underdeveloped to 7=well developed and efficient by international standards) (WDI, 2019)

Fixed Effects Within-Group Model
The heterogeneity of the data has characteristics of individual country specificity thus, the fixed effects in essence overcomes the challenges of unobserved heterogeneity. To estimate fixed effect with large sample size we specify model as:

$$y_{it} = \alpha_0 + \sum_{j=2}^{k} \alpha_j x_{jit} + \sum_{p=1}^{s} \beta_p z_{pi} + u_{it} \dots\dots\dots\dots\dots\dots\dots\dots\dots\dots\dots\dots 1$$

Y denotes the dependent variables; X_j represents the observed explanatory variables, while Z_p represents the unobserved explanatory variables.

It is assumed that the unobserved effect which is a challenge in panel estimation does not vary over time and given that it is unobserved and difficult to measure, hence the model can be re-written as:

$$\delta_i = \sum_{p=1}^{s} \beta_p z_{pi}$$

$$y_{it} = \alpha_0 + \sum_{j=2}^{k} \alpha_j x_{jit} + \delta_i + u_{it} \dots\dots\dots\dots\dots\dots\dots\dots\dots\dots\dots\dots\dots\dots\dots 2$$

Where δ_i is described as an individual unobserved specific effect which mitigate the robustness of estimation hence can be controlled in the following approach. Some of which include the use of dummy variable as different variables in the model. For instance, within-groups with fixed effects, the change or variation is therefore explained on the mean of the dependent variable. However, this method has potential problems such as the loss of the *x* variables that remains constant.

$$y_{it} - \overline{y} = \sum_{j=2}^{k} \beta_j (x_{ijt} - \overline{x}_{ij}) + (u_{it} + \overline{u}_i)\dots\dots\dots\dots\dots\dots\dots\dots\dots\dots\dots\dots 3$$

The unobserved country specific effect disappears from this model and is known as the within-groups regression model since it explains the changes or variations about the mean of the dependent variable resulting from the changes or variations about the means of the explanatory variables for the group of observations relating to a given individual.

However, taking first-differences of the variables, the problem with the *x* variable persist; similarly, this technique removes any problem of first-order autocorrelation. If the unobserved effects are distributed randomly, we can treat the α_i as random variables, drawn from a given distribution. This involves subsuming the unobserved effects into the disturbance term to give:

$$y_{it} = \alpha_0 + \sum_{j=2}^{k} \alpha_j x_{jit} + v_{it} \dots v_{it} = \delta_i + u_{it} \dots\dots\dots\dots\dots\dots\dots\dots\dots\dots\dots\dots 4$$

This is a random effects type of model and is in general better than the fixed effects model as characteristics that remain constant for each individual that remain in the model but have to be removed for fixed effects models (Nwakuya and Ijomah, 2017). In the case of selecting the most appropriate technique of estimation to be adopted, the Hausaman specification test is employed and the rule of thumb state that, If the probability value <0.05, then FE otherwise RE model should be selected.

4. Results
From the result of the descriptive statistics, the minimum value of working poverty exert on GDP per capital is 1.9, while the maximum value is 69.3. The mean average value of working poverty is 37.07762, while its standard error is 16.80925.

The minimum value of inflation on GDP per capital is -3.231812, while the maximum value is 34.69527. The mean average value of inflation is 5.428511, while its standard error is 5.8067.

The quality of port infrastructure on GDP per capital has a zero minimum value, its maximum value is 5.23413. The mean average value for quality of port infrastructure is 3.703219, while its standard error is .8411533.

Table 1: Descriptive Statistics

Variable	Obs	Mean	Std Dev	Min	Max
Gdpperc	210	1136.529	820.0598	323.3892	3740.389
airtrafrie~t	130	4.851562	10.08072	0	53.71972
Qua	107	3.703219	.8411533	0	5.23413
Infla	197	5.428511	5.8067	-3.231812	34.69527
Worpov	210	37.07762	16.80925	1.9	69.3

Source: Author's Computation

Air transport services also have zero minimum value on GDP per capital, with a maximum value of 53.71972. The mean average value of air transport services is 4.851562, while its standard error is 10.08072.

Table 2: Static Models

Variable	Fixed effect	Random effect
Airtrafrieghtc	-.0461656***	-.0373159***
	.0222908	.0218735
Qual	.6185498***	.4739731***
	.2770639	.2645242
Inflat	.0028767*	.0041811*
	.0271591	.0271137
Worpoverty	-.3555131***	-.308061***
	.1826369	.1321287
Constant	7.582661	7.511472
	.5656551	.5283921

Source: Author's Computation
*Notes ***, **, * are statistical significance at 1%, 5% and 10% level respectively, t-statistic (in parenthesis) are based on white heteroscedacity consistence (HAC) standard errors, p-values reported for AR(2) and Hansen statistics.*

The rule of thumb says If in any case, the probability value <0.05, FE should be selected and if otherwise, the RE model should be selected

Test: Ho: difference in coefficients not systematic

$$chi2(4) = (b-B)'[(V\_b-V\_B)^(-1)](b-B)$$
$$= 3.11$$
Prob>chi2 = 0.5392
(V_b-V_B is not positive definite)

Thus, the random effect is selected in this case to posit relationship among regressors. From the result in table 1, air transportation posits a negative and significant effect on GDP per capital.
Infrastructural quality of port has a positive and significant effect on GDP per capital. However, working poverty has a negative and significant impact on GDP per capital in west African countries.

Table 3: Panel Vector Auto Regression Causality Test

Var	Coefficient and Z statistics
Gdpperca	.1351886*
	.5723952
Airtrafrieghtc	-.0382762*
	.0625547
Gdpperca	.8555142***
	.4147862
Qual	8555142***
	.4147862
Gdpperca	.8223546***
	.1683467
Infla	-.0651474***
	.0216911
Gdpperca	.8202475***
	.1643344
Worpoverty	.809693*** .
	0712496

Source: Author Computation
*Notes: *** ** *denotes statistical significance at 1%, 5% and 10% respectively Z statistics (n parentheses).*

The result of the panel vector autoregressive model shows that air transport freight does not granger causes GDP per capital. Quality of port infrastructure and GDP per capital has a bi- directional relationship. There is also a bi directional relationship between Inflation and GDP per capital. Similarly, a bi-directional relationship also exists between working poverty and GDP per capital.

Table 4: Postestimation Test

Variable	Coefficients
Airtrafrieght	-18.9471
	7.501681
Qua	255.5912
	172.9085
Infla	3.469419
	14.94063
Worpov	-20.2753
	27.51026

Source: Author's Computation

Since the houseman specification test reported that, the random effect regression model is the most appropriate, this study includes the time varying effect and country specific effect and VCE robust option to account for auto correlation and heteroscedastic problem. From the result, significant changes have revealed the standard errors coefficient and significant p-values

5. Conclusion and recommendations
West African region may have recorded growth in GDP as a result of key performance indicators, but the most supportive mechanism that has yielded this

progress is a quality and well function port system in the last four decades. This implies that, despite the dwindling trade cycle and recessionary period, the region still maintain a fair stable growth amidst increased cost of imported and exported goods and by virtue of the nature of commodity goods. This questions how much impact the port services have on GDP for the period 2006 to 2019? From the findings, the following conclusions can be deduced.

Infrastructural quality of port has a positive and significant effect on GDP per capital. This shows that investing in port Infrastructure cannot be understated. More so, it has implication in facilitating foreign investors, goods and services into the region thus reducing the cost of import and export as well.

This study also shows that, quality port is a great asset to West African economies owing to too much dependence on commodity goods and land lock nature. Not only port Infrastructural has contributed to successful growth in GDP. Rather, other complements such as logistics infrastructure leading to ports, Customs and security clearing, Safety and regulations also drive growth.Therefore, implication is that there is need for a liberalization of port will strengthen supply chain.

However, working poverty has a negative and significant impact on GDP per capital in West African countries. The negative sign of poverty can be associated with a large decline in the share of labour force in agriculture, industry and small scale businesses in West Africa. Implication is that, if any success in growth is to be attained, inclusive growth,Labour force reallocations from the traditional, subsistence, low-productivity sectors to the modern high-productivity sectors must bear key part of African growth accelerations and a key strategy to attaining this goal.

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