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TAXATION AND TRANSPORTATION: GRANGER CAUSALITY APPROACH IN NIGERIA

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Abstract: This study gauges taxation's effect on transportation from 1981 to 2019 in Nigeria. This study further assesses the bearing of causality among Transportation, Corporate tax, Petroleum profit tax, Value added tax and Custom and Excise duties. Analytical tools such as VECM, Johanson Test for Cointegration, Vector Autoregression and granger causality Wald (GCW) test are adopted for analysis. Diagnosis tests such as the Lagrange-multiplier test, Jarque-Bera test and Eigenvalue stability condition are carried out to examine autocorrelation, stability and normality tests respectively. Outcomes divulge that corporate tax has a positive short-run and long-run influence on transportation. Petroleum profit tax, Value added tax and Custom and Excise duties also impact transportation positively and significantly both in the long run and short run as deduced from empirical analysis. This reveals that all the components of taxation observed influence transportation positively both in the long run and short run in Nigeria. Conclusively, taxation impacts transportation positively and significantly both in the short run and long run. This translates that taxation income has been utilized effectively to upsurge transportation in Nigeria. It predicts that transportation will perform excellently in terms of economic development and employment generation if taxable income is properly monitored and utilized effectively.

Keywords: Transportation; Granger Causality; Taxation; VAR; Dickey-Fuller Test.

JEL Classification: R420; H200; C580; C120.

1. Introduction

The essentiality of transportation in any country cannot be underestimated because the movement of both human and material resources is very vital for the development of any nation in the world. Transportation, which is germane to

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economic development, has been regarded as the major channel for linking both human and material resources to the major users within and outside the country. It is advocated that without this indispensable channel, the resources needed for the production of essential commodities for effective usage of the populace would not have been attained, the standard of living would not have been improved, and the growth of economy and advancement of technology would have been derailed. When goods and services are produced, it is pertinent to reach the final consumers through transportation. This, therefore, displayed the essentiality of transportation in the country. Transportation splits into road, water, and air transportation. It is not limited to these but extended to government expenditure on transportation infrastructure. The role of transportation in sustainable development cannot be underrated. It is harmoniously recognized that transportation is important for achieving sustainable development in the country which also enhances productivity in terms of health, security, food, economic growth, energy, infrastructure, and cities as well as human settlements.

The government finances transportation through the income realized from taxation in Nigeria. In 2000, according to CBN (2019) reports, money expended by the Nigerian government on transportation increased from #3.03bn to #33.93bn in 2001 when non-oil revenue was also increased from #314bn to #903.46bn. This was further decreased to #29.39bn in 2002 when nonoil revenue was reduced to #500.99 bn. Government expenditure on transportation drastically reduced to #8.04bn in 2005 contrary to nonoil revenue that increases from #500.99 bn to #.10bn, aftermath, it was upsurged to #90bn in 2009, when #1,652.65 bn was forming nonoil revenue. It was reduced to #42.40bn in 2010 when nonoil revenue was #1,907.58 bn. Transportation expenditure of the government was 13.1bn and #23.2bn in 2011 and 2012 when nonoil revenue was 2,237.88 and 2,628.78 respectively. This expenditure further increased to #40.74bn in 2019 when #4,725.60 bn from nonoil revenue realized by the government during the year. Taxation revenue is the subset of nonoil revenue which took more than 75% of the nonoil revenue garnered by the federal government through company income tax, petroleum profit tax, value-added tax and custom and excise duties (Adegbite, 2020).

According to Ayeni, and Afolabi, (2020), the federal government currently improved Nigeria tax policy and administration to upsurge actual tax income through formulated policies on the enhancement of taxation components' returns to cater for transportation and other essentialities Government has been shifted its focus to taxation for exigent revenues generation taxation to bridge revenue gaps ignited by oil crash in the world market. It was discovered that all the extant researchers concentrated on the effects of taxation on economic growth, employment, revenue generation, economic development and stability but declined

such effects on transportation expenditure in the country. But the effects of taxation on the expenditure of government on transportation are the notion behind this study which makes it distinct from the existing literature. Therefore, this study gauged the divergent effect of taxation components on transportation in Nigeria.

2. Literature review

2.1. Transportation and Taxation

Transportation refers to the conveyance of persons and goods from one area to another place. The growth of a nation depends on various channels by which the movement of goods and persons is actualized. Transportation has been seen as one of the integral parts of the developed nation because transportation of large quantities of goods and people over a long distance in safety and comfort has been an index of technological progress and civilization. It regards as the easiest technique to transport animals, humans, and goods from one place to another. This can be done through effective transportation which includes land (spilled into road and rail), water, pipeline, space and cable. Transportation fields are also split into vehicles, infrastructure, and operations. Transport emits trade among people, which is necessary for the civilization development through transport infrastructure which embedded with fixed installations, railways, roads, airways, waterways, pipelines and canals, airports terminals, train stations, bus stations, trucking terminals, warehouses, refueling depots (embedded with fueling stations and docks) and seaports. The terminal can be used for swapping cargo and passengers as well as maintenance. The vehicles aspect of transportation refers to automobiles, buses, bicycles, trains, helicopters, trucks, watercraft, aircraft and spacecraft. While operations entail how vehicles function, and the techniques in place for the operations which include legalities, financing, and policies. These are provided by the government from their sourced revenue which is derived from taxation income through company income tax, petroleum profit tax, value-added tax, and custom and excise duties.

It is recognized that transportation is central to achieving the sustainability targets through effective allocation, monitoring, and utilization of taxation revenue. Taxation has been seen to enhance transportation productivity which also plays an integral part in globalization and economic growth. In addition, enormous volumes of land for transportation are greatly subsidized through taxation revenue by the government. Therefore, transportation is a function of taxation revenue.

2.2. Theoretical Underpinning

2.2.1. Principle of Utility/Benefit Approach

This theory postulated that the utility derived from the consumption of commodities are the yardsticks and parameters to gauge the tax to be subscribed to

the state by the individual and private sectors. It postulated further that the contractual agreement between the state and individuals or private sector should be based on the utility provided and enjoyed by the state and the private sector respectively. It is stated that the money forcefully collected from the individual as taxes should be utilized to provide benefits for the populace. This further displayed that utility must be derived from the services provided in returns for individual and private sectors'subscriptions to the government purse. Government dispenses benefits to the taxpayers by providing varieties of services such as transportation and other essential services. Moreover, this theory advocated that fairness or equity in tax payment should be done in a proportion to the utility and welfares benefited as a substitute to the government services provision.

This theory has been criticized because the yardstick to measure the benefits enjoyed was not well defined by this theory. Furthermore, enormous expenditures expended by the government in services provided are indivisible to commensurate taxes. However, the theory can be applied really where the beneficiaries of such services are clearly and easily traceable. Therefore, this study hinged on the utility/ benefits theory.

2.3. Empirical Review of Related Studies

Storchmann (2001) studied fuel taxes' impact on German public transport. Absolute percentage error; mean error, root mean square error (RMSE) were adopted for analysis. It was concluded that increment in fuel taxes impacted public transport negatively in Germany. Meanwhile, this study ignited in Germany, and the results deduced are not meant for taxation and transportation policy in Nigeria.

Boopen (2006) gauged transport capitals' contribution on Sub Saharan growth in Africa and a Small Island Developing States (SIDS), employing panel data and cross sectional analysis to determine transport contributions on growth. It was concluded absolutely that transport capital is a significant contributor to the progress of economy of observed countries. Analysis further divulged that the transport capital productivity is superior and pertinent on countries' growth. However, this study gauged the relationship amid transport capital and economic growth but not on taxation and transportation. Therefore, the results garnered are less important to Nigeria on transportation decisions.

Akanbi, Bamidele and Afolabi (2013) gauged transportation infrastructure enhancement's impact between 1981 and 2011 on Nigeria's economic growth employing OLS technique to determine the impact. The study exposed that the investment in transportation infrastructures triggered significant, strong and positive contributions to economic growth. But this study is emphasized on transport infrastructure's effect on growth which was distinct from the current study. Therefore, findings were meaningless to Nigeria on taxation's relationship

with transportation. In another examination by Aderanijo and Bakare (2018) which appraised tax revenue's effect on Osun state infrastructural development using survey data for analysis. Tax revenue was found as a strong and powerful tool for Osun state infrastructural development. It was further stated that incapability to garner tax income dispensed underdevelopment in Osun state. However, the study's scope was confined to Osun state but was not elongated to Nigeria as a whole, therefore, the study lack generalization.

Uma, Ogbonna, and Hyacinth (2014) examined the effect of the transportation network in Nigeria employed time-series data from 1981-2009 which were analyzed through Phillips-Perron (PP) and ADF unit root tests together with Ordinary least square to determine the effect of transportation networks, which was confined only to road transport on economic growth. Road transport has been seen as the pertinent and effective transport that impacted economic growth significantly and strong in Nigeria. Nevertheless, the study is confined to road transportation's effect on economic growth but not streamlined to taxation.

Radu (2014) investigated the effect of tax evasion in Alba County and the Braşov Region. Data on tax audit and budget revenues were collected from Alba county and Braşov Region. It was concluded after several investigations that tax evasion hurt tax revenue in the region. According to the study, a reduction in tax evasion could increase revenue from taxation in the region. However, this study is from Alba county and Braşov Region in which the decision is extremely distinct to Nigeria.

In another study, Radu, Dumiter, and Opret, (2015) analyzed the tax wedge between labor costs and net wage in OECD countries and Romania. Data used were collected from the database of OECD. According to the outcome of the research, high compulsory levies and low wages have negative effects on the emigration of workers in OECD and Romania. However, this study was strictly confined to OCED countries and Romania.

Agbigbe (2016) determined the relationship between road network investment and Nigeria's economic development. Personal interviews were adopted for data collection through a purposeful sample and selection of 20 respondents who are directly involved in road networks investment currently, such as individuals, private sector and public sectors transportation. Findings exposed that corruption in contracts awarding, monitoring impotence, and ineffective governance as hindrances of development in Nigeria's economy. In the same vein, Olamigoke and Adebayo (2013) investigated the role of transportation on local economic development. The study employed qualitative means in determining the role of transportation on local economic development. It was concluded that transportation is an integral sector that determined the variance of development of the local economy in Nigeria but is faded by corruption. These studies are specified on

economic development which is not compatible with the current study. Therefore, the findings are not embedded with current taxation forecasting.

Vlad, Ibadula, and Brezeanu (2016) examined taxes' contribution to the implementation of the public governance strategy in eastern European countries from 2002-2014. Simple linear regression was employed for the analysis. Fiscal policies contributed a lot to developing government strategy. Also, public debt and fiscal pressure are connected that is the fiscal policy was influenced by the public debt level in the country. It was also found that a strong correlation between total tax revenues and social contributions was sustained.

Gwa and Kase (2018) examined tax revenue contribution to Nigeria's economic growth. The study principally used time series, which were collected through CBN and FIRS statistical bulletin from 1997 to 2016. OLS model was engaged to establish tax revenue contribution on economic growth. The finding publicized that company income tax and value-added tax contributions on the economic growth of Nigeria were positive and significant. The finding further publicized that petroleum profit tax contribution on the growth was not significant. This study is also on tax revenue on economic growth, but the result devoided the evidence on transportation which makes it disregarded for taxation and transportation forecasts.

Adegbite and Fasina (2019) examined taxation effects on revenue generation in Nigeria. It also analyzed the causal direction amid taxation and revenue generation utilizing the Johansen co-integration method and test of Granger causality using secondary data covering 1970 to 2017. Results presented that petroleum profits tax had a positively significant effect on revenue. Company income tax, Value added tax, and custom and excise duties also had a positive significant effect on revenue. But custom and excise duties have the lowest significant impact on revenue both in the short run and in the long run. Taxation had bidirectional causality with government revenue in Nigeria. The study predominantly concluded that taxation had a positive significant short-run and long-run impact on revenue generation of government. Nevertheless, the study was streamlined to revenue and taxation which did not elongate to transportation in Nigeria.

Omodero (2019) considered the effect of shadow economy and corruption on tax revenue performance in Nigeria using secondary data covered from 1996 to 2018. This period was overwhelmed with a corruption perception index captured by Transparency International for Nigeria. The ordinary least squares technique was specifically employed to analyze the effect of shadow economy and corruption on tax revenue. The empirical results opined that both the shadow economy and corruption had negative effects on tax revenue performance in Nigeria. However, this empirical research was restricted to corruption and shadow economy.

Ayeni and Afolabi (2020) examined predominantly the dynamic relationship among tax revenue, economic growth, and Nigeria infrastructural development

employing data from 1981 to 2018 through Nigeria CBN. ADF and PP units root test, and Johansen Cointegration test was employed to determine the relationship and cointegrated equations. Unidirectional causality was disclosed which ran from tax revenue to economic growth, and from economic growth to infrastructure. But bi-directional causality was found amid infrastructural development and tax revenue which translated that tax revenue encouraged infrastructure and economic growth, while infrastructure significantly influenced tax revenue but did not influence economic growth.

Adegbite and Olaoye (2021) examined how taxation affects foreign direct investment and economic services in Nigeria. The study analyzed the data collected from CBN with Cointegration, VECM, and granger causality test. The study further employed a unit roots test to determine the stationary of the variables employed. It was discovered from the study that taxation had a negative effect on FDI but a positive significant effect on economic services in Nigeria. However, this study was streamlined to FDI and economic services in Nigeria. Therefore, the outcome is invalid to transportation as a scope.

This study created research gaps in the scope, methodology, and the concept of existent literature. The scope in the sense that this study encompassed the area of coverage from 1980 to 2019 which has not been in existence on the examination of taxation effect on transportation in Nigeria. Also, there are no extant studies on the effect of taxation on transportation in Nigeria which makes this study distinct from existing literature. More so, the econometrics involvement to examine the effect of taxation on transportation such as VECM, VAR, and other diagnostic tests make the study more robust. Based on these research gaps created, this is therefore hypothesized as:

H_1: Taxation revenue influences transportation significantly in Nigeria.
H_2: Taxation has a long-run connection with transportation in Nigeria.
H_3: Causality ignited between taxation and transportation in Nigeria.

3. Methodology

Company income tax (COMITAX), Petroleum profit tax (PETRTAX), Value added tax (VALUTAX), Custom and Excise Duties (CUDETAX), and transportation (TRANPC) were harvested from CBN and FIRS bulletin ranging from 1981 to 2019 in order to realize the econometric impact of taxation on transportation in Nigeria through regression model, Cointegration analysis, VECM and granger causality Wald (GCW) test. COMITAX refers to the thirty percent (30%) income realized from the income of private sectors and individuals. COMITAX data was gotten from the annual publication of FIRS, which is saddled with the responsibility of collecting COMITAX. PETRTAX also refers to the tax collected from companies that engaged in oil and gas. This data was also realized

from FIRS annual bulletin from 1981 to 2019. In addition, VALUTAX is the tax collected from every stage of production which is charged at 7.5% on every stage of production. The final burden of this tax falls on the final consumer. Data on VALUTAX were discovered from both CBN statistical bulletin and FIRS publication. CUDETAX is the tax on the import and export goods which are within the purview of custom authority. Data on CUDETAX were collected from the publication of CBN and custom authority in Nigeria. TRANPC which is the expenditures on transportation by the government were realized from the publication of CBN in Nigeria.

Model Specification

To gauge the taxation effect on transportation in Nigeria, transportation (proxied by expenditure on transportation) is regarded as a dependent variable while independent variables are limited to four taxation components such COMITAX, PETRTAX, VALUTAX, and CUDETAX.

The regression model is specified as follows:

$$TRANPC = f\ (COMITAX, PETRTAX, VALUTAX, CUDETAX, \mu) \quad (1)$$

$$TRANPC = \alpha_0 + \beta_1\ COMITAX + \beta_2\ PETRTAX + \beta_3\ VALUTAX + \beta_4\ CUDETAX + \mu_1 \quad (2)$$

VAR Model is specified below in first difference stationary $I(1)$ are for this study as follows:

$$TRANPC_t = \alpha + \sum_{i=1}^{k} \beta_i TRANPC_{t-i} + \sum_{j=1}^{k} \emptyset_i COMITAX_{t-j} + \sum_{m=1}^{k} \emptyset_m PETRTAX_{T-M} + \sum_{n=1}^{k} \emptyset_n VALUTAX_{t-n} + \sum_{s=1}^{k} \emptyset_s CUDETAX_{t-s} + \mu_{2t} \quad (3)$$

$$COMITAX_t = \alpha + \sum_{i=1}^{k} \beta_i \Delta TRANPC_{t-i} + \sum_{j=1}^{k} \emptyset_i \Delta COMITAX_{t-j} + \sum_{m=1}^{k} \emptyset_m \Delta PETRTAX_{t-m} + \sum_{n=1}^{k} \emptyset_n \Delta VALUTAX_{t-n} + \sum_{s=1}^{k} \emptyset_s CUDETAX_{t-s} + \mu_{3t} \quad (4)$$

$$PETRTAX_t = \alpha + \sum_{i=1}^{k} \beta_i \Delta TRANPC_{t-i} + \sum_{j=1}^{k} \emptyset_i \Delta COMITAX_{t-j} + \sum_{m=1}^{k} \emptyset_m \Delta PETRTAX_{t-m} + \sum_{n=1}^{k} \emptyset_n \Delta VALUTAX_{t-n} + \sum_{s=1}^{k} \emptyset_s CUDETAX_{t-s} + \mu_{4t} \quad (5)$$

$$VALUTAX_t = \alpha + \sum_{i=1}^{k} \beta_i \Delta TRANPC_{t-i} + \sum_{j=1}^{k} \emptyset_i \Delta COMITAX_{t-j} + \sum_{m=1}^{k} \emptyset_m \Delta PETRTAX_{t-m} + \sum_{n=1}^{k} \emptyset_n \Delta VALUTAX_{t-n} + \sum_{s=1}^{k} \emptyset_s CUDETAX_{t-s} + \mu_{5t} \quad (6)$$

$$CUDETAX_t = \alpha + \sum_{i=1}^{k} \beta_i \Delta TRANPC_{t-i} + \sum_{j=1}^{k} \emptyset_i \Delta COMITAX_{t-j} + \sum_{m=1}^{k} \emptyset_m \Delta PETRTAX_{t-m} + \sum_{n=1}^{k} \emptyset_n \Delta VALUTAX_{t-n} + \sum_{s=1}^{k} \emptyset_s CUDETAX_{t-s} + \mu_{6t} \quad (7)$$

VECM model is also specified below as follows:

$$\Delta TRANPC_t = \alpha + \sum_{i=1}^{k-1} \beta_i \Delta TRANPC_{t-i} + \sum_{j=1}^{k-1} \emptyset_i \Delta COMITAX_{t-j} + \sum_{m=1}^{k-1} \emptyset_m \Delta PETRTAX_{t-m} + \sum_{n=1}^{k-1} \emptyset_n \Delta VALUTAX_{t-n} + \sum_{s=1}^{k-1} \emptyset_n \Delta CUDETAX_{t-s} + \lambda ECT_{t-1} + \mu_{7t} \quad (8)$$

$$\Delta COMITAX_t = \alpha + \sum_{i=1}^{k-1} \beta_i \Delta TRANPC_{t-i} + \sum_{j=1}^{k-1} \emptyset_i \Delta COMITAX_{t-j} + \sum_{m=1}^{k-1} \emptyset_m \Delta PETRTAX_{t-m} + \sum_{n=1}^{k-1} \emptyset_n \Delta VALUTAX_{t-n} + \sum_{s=1}^{k-1} \emptyset_n \Delta CUDETAX_{t-s} + \lambda ECT_{t-1} + \mu_{8t} \quad (9)$$

$$\Delta PETRTAX_t = \alpha + \sum_{i=1}^{k-1} \beta_i \Delta TRANPC_{t-i} + \sum_{j=1}^{k-1} \emptyset_i \Delta COMITAX_{t-j} + \sum_{m=1}^{k-1} \emptyset_m \Delta PETRTAX_{t-m} + \sum_{n=1}^{k-1} \emptyset_n \Delta VALUTAX_{t-n} + \sum_{s=1}^{k-1} \emptyset_n \Delta CUDETAX_{t-s} + \lambda ECT_{t-1} + \mu_{9t} \quad (10)$$

$$\Delta VALUTAX_t = \alpha + \sum_{i=1}^{k-1} \beta_i \Delta TRANPC_{t-i} + \sum_{j=1}^{k-1} \emptyset_i \Delta COMITAX_{t-j} + \sum_{m=1}^{k-1} \emptyset_m \Delta PETRTAX_{t-m} + \sum_{n=1}^{k-1} \emptyset_n \Delta VALUTAX_{t-n} + \sum_{s=1}^{k-1} \emptyset_n \Delta CUDETAX_{t-s} + \lambda ECT_{t-1} + \mu_{10t} \quad (11)$$

$$\Delta CUDETAX_t = \alpha + \sum_{i=1}^{k-1} \beta_i \Delta TRANPC_{t-i} + \sum_{j=1}^{k-1} \emptyset_i \Delta COMITAX_{t-j} + \sum_{m=1}^{k-1} \emptyset_m \Delta PETRTAX_{t-m} + \sum_{n=1}^{k-1} \emptyset_n \Delta VALUTAX_{t-n} + \sum_{s=1}^{k-1} \emptyset_s \Delta CUDETAX_{t-s} + \lambda ECT_{t-1} + \mu_{11t} \quad (12)$$

Where TRANPC is transportation which is a proxy of money expended by the federal government on transportation. α is intercepted, β_i, $\emptyset_i$ $\emptyset_m, \emptyset_n$ *and* $\emptyset_s$ are taxation coefficients of TRANPC, COMITAX, PETRTAX, VALUTAX and CUDETAX respectively while t, s, i, m, n, and s are lags numbers. μ_{1-11t} are stochastic (error term) with constant variance and zero mean.

4. Results and discussion

4.1. Impact of taxation on Transportation

Table 1 The Effect of Taxation on Transportation

Dependent variable	Independent variables	Coefficient	Standard error	T	P>/T/	(95% conf. Interval)
TRANPC	COMITAX	.0212454	.0071055	2.99	0.036	.0039597 .0464504
	PETRTAX	.0012329	.0002901	4.25	0.000	.0018225 -.0206434
	VALUTAX	.0511682	.0166671	3.07	0.014	.0172967 .0850394
	CUDETAX	.0167791	0.0672855	4.01	0.001	.0031215 .0469799
	CONSTANT	2284.731	609.2621	3.75	0.009	3897.229 8466.691
R-squared = 0.5642	Adj R-squared = 0.5129	Prob> F = 0.0000	Root MSE = 14049		F(4, 34) = 11.00	

Source: Author's computation (2020)

Table 1 opined taxation influence on transportation in Nigeria. A unit increase in COMITAX increases TRANPC by 0.21 units. This advocates positive significant effect of COMITAX on TRANPC (β=.0212454, t= 2.99, P>|t|=0.036). Also, One unit increase in PETRTAX increases transportation by 0.0012 unit which displayed that the effect is significant (β= .0012329, t= -4.25, P>|t|=0.000). Moreover, a unit increase in VALUTAX increases TRANPC by 0.051 units. This means VALUTAX imparted TRANPC positively and significantly (β=.0511682, t=3.07,

P>|t|=0.014). This means that if VALUTAX increases TRANPC increases. Furthermore, a unit increases in CUDETAX increases TRANPC by 0.016 units. This advocates positive significant effect of CUDETAX on TRANPC (β=.0167791, t= 4.01, P>|t|=0.001). R^2 and Adjusted R^2 of 0.5642 and 0.5129 respectively advocate the fitness of the model incorporation to determine taxation effect on TRANPC.

Table 2 Test of Unit Roots

Variable	Dickey-Fuller Test Statistic	1% Critical Value	5% Critical Value	10% Critical Value	Prob.	Order of Integration	Remarks
TRANPC	-5.045	-3.668	-2.966	-2.616	0.000	*I*{1)	Stationary
COMITAX	-5.467	-3.668	-2.966	-2.616	0.000	*I*{1)	Stationary
PETRTAX	-3.014	-3.668	-2.966	-2.616	0.010	*I*{1)	Stationary
VALUTAX	-6.552	-3.668	-2.966	-2.616	0.000	*I*{1)	Stationary
CUDETAX	-4.196	-3.668	-2.966	-2.616	0.007	*I*{1)	Stationary

Source: Author's computation (2020)

It was discovered from Dickey-Fuller Test Statistic in Table 2 that all the variables observed were not stationary in the level deference but stationary in the first difference. This is evident enough to concur to long-run relationship connections amidst the variables observed.

Selection Order Criteria Test (SOCT)

Table 3 Selection-Order Criteria

Lag	LL	LR	Df	P	FPE	AIC	HQIC	SBIC
0	-2438.51				3.0e+54	139.629	139.706	139.851
1	-2304.98	267.06	25	0.000	6.2e+51	133.427	133.887	134.76
2	-2246.87	116.2	25	0.000	1.0e+51	131.536	132.379	133.98
3	-2135.29	223.17	25	0.000	9.4e+48*	126.588*	127.815*	130.143*
4	-1920.6	429.38*	25	0.000	3.2e+44	115.748	117.359	120.414

Endogenous: TRANPC, COMITAX, PETRTAX, VALUTAX, CUDETAX
Exogenous: _cons
Source: Author's computation (2020)

To dodge underestimation and overestimation of employed Lag, SOCT was analyzed which advocated for Lag 3 as determined by AIC, FPE, HQIC and SBIC in Table 3 with 9.4e+48*, 126.588*, 127.815* and 130.143* respectively.

Table 4 Johnson Test for Cointegration

Rank	Eigen Value	Parm	LL	Trace statistic	5% critical value	1% critical value
0	-	80	-2179.3597	457.0514	68.52	76.07
1	0.99589	89	-2096.2139	264.7157	47.21	54.46
2	0.97954	96	-2028.9805	128.5969	29.68	35.65
3	0.89933	101	-1973.4519	48.2384	15.41	20.04
4	0.72993	104	-1958.9718	2.4208*1*5	3.76	6.65
5	0.06683	105	-1955.1858			

Source: Author's computation (2020)

Table 4 dispensed information on trend specification, sample, and cointegrating equations invoked in the model. It was observed from Table 4 that four cointegrating equations existed because of trace statistics value of 2.4208*1*5 which below 3.76 and 6.65 of 5% and 10% critical values respectively.

Table 5 Vector Autoregression

Equation	Parms	RMSE	R sq	chi2	P>chi2
TRANPC	21	8681.57	0.9972	12582.95	0.0000
PETRTAX	21	2.6e+06	0.9905	3667.258	0.0000
VALUTAX	21	13526.7	0.9992	44484.07	0.0000
CUDETAX	21	17813	0.9985	22793.65	0.0000
COMITAX	21	64942.5	0.9911	3876.692	0.0000
Log likelihood =-1920.598	Det(Sigma_ml) = 3.17e+41	AIC = 115.7484	HQIC =117.3592	SBIC = 120.4145	

Source: Author's computation (2020)

Table 5 showed the long-run relationship between transportation and the component of taxation examined. It was discovered from table 4 that transportation and PETRTAX possessed long-run causality because P>chi2 with the value of 0.0000, which below 0.05. In addition, VALUTAX, CUDETAX and COMITAX displayed positive long-run causality with TRANPC because P>chi2 of 0.000 below 0.05 significant threshold.

Table 5.1 Vector Autoregression

Dependent variable	Independent variables	Coefficient	Standard error	z	P>/z/	(95% conf. Interval)
TRANPC	TRANPC L1	.6437465	.1678413	3.84	0.000	.3147836 .9727094
	L2	9322592	.1780157	5.24	0.000	12.81164 .5833549
	COMITAX LI	.0112435	.0102767	1.09	0.274	.0313855 .0088984
	L2	.0271437	.0106701	2.54	0.011	.0480567 .1062306
	PETRTAX L1	.0009341	.0006756	1.38	0.167	.0022582 .00039
	L2	.0016277	.0005227	3.11	0.002	.0026522 .0046031
	VALUTAX LI	.0152458	.0132018	1.15	0.248	.0411209 .0106293
	L2	.1106192	.0431839	2.56	0.010	.0259803 .1952581
	CUDETAX L1	.0972602	.0752324	1.29	0.196	.0501927 .244713
	L2	.0704383	.0751812	0.94	0.349	.0769141 .2177907
	CONSTANT	1735.369	2368.122	0.73	0.464	1376.803 2906.066

Source: Author's computation (2020)

Table 5.1 is also the output of VAR which showed the exact lag in which taxation components affect TRANPC. VAR model displayed that COMITAX in lag 1 has no significant effect on TRANPC (β =.0112435, z= 1.09, P>|z|=0.274), but in Lag 2, it exhibited significant effect, which is positive, on TRANPC (β =.0271437, z= 2.54, P>|z|=0.011). In the same vein, PETRTAX did not have significant effect on TRANPC at lag 1 because P>/z/ value of 0.167 is above 0.05. But in lag 2, PETRTAX displayed positive significant effect on TRANPC (β=.0016277, z= 3.11, P>|z|=0.002). That is, a percentage increases in PETRTAX enhanced TRANPC by 0.0016%. Also, VALUTAX in lag 1 has no significant effect on TRANPC (β =.0152458, z= 1.15, P>|z|=0.248), but in Lag 2, it exhibited significant effect, which is positive, on TRANPC (β =.1106192, z= 2.56, P>|z|=0.010). Contrarily, CUDETAX has positive effect on TRANPC but not significant both in Lag 1 (β =.0972602, z= 1.29, P>|z|=0.196) and Lag 2 (β =.0704383, z= 0.94, P>|z|=0.349).

Table 6 Post-Estimation Test

Heteroskedasticity Test	Chi-sq 13.55412	df 25	Prob. 0.772
Serial correlation test	Lags 3	LM-Stat 5.534973	Prob 0.5935

Source: Author's computation (2020)

Table 6 showed heteroskedasticity and serial correlation test results for VAR model. The null hypothesis of the two tests opined that serial correlation and heteroskedasticity are absent in the model. With probability (Prob.) values of 0.772 and 0.5935 for serial correlation and heteroskedasticity respectively. Therefore,

there is no sufficient proof to discard the null hypotheses. That is no serial correlation and heteroskedasticity existed within the observations.

Table 7 Short-run influence of Taxation on TRANPC Through VECM

Equation	Parms	RMSE	R sq	chi2	P>chi2
D_ TRANPC	17	10348.7	0.7302	48.71392	0.0001
D_ COMITAX	17	134394	0.8953	153.9599	0.0000
D_ PETRTAX	17	1.6e+06	0.9868	1341.084	0.0000
D_ VALUTAX	17	36133.8	0.9560	391.1637	0.0000
D_ CUDETAX	17	34651.3	0.9472	323.0365	0.0000
Log likelihood = -2052.956	Det(Sigma_ml) = 6.10e+44	AIC = 122.3975	HQIC = 123.7627	SBIC = 126.3525	

Source: Author's computation (2020)

Table 7 showed the short-run influence of taxation components on TRANPC. P>chi2 of all the variables observed divulged shortly run effect on TRANPC because the values are 0.0000; 0.0000; 0.0000; and 0.0000 respectively which absolutely below the threshold of 0.05 sig. level.

Table 7.1 Vector Error Correction Model (VECM)

Dependent variable	Independent variables	Coefficient	Standard error	z	P>/z/	(95% conf. Interval)	
	- Ce1 L1	.901411	.6877473	1.31	0.190	.446549	2.249371
	- Ce2 L2	-.0010836	.0009186	1.18	0.238	-.002884	.0007168
TRANPC	TRANPC LD	-.7441075	.497234	1.50	0.135	-1.718668	.2304532
	L2D	-2.311428	1.184249	-1.95	0.051	-4.632514	.0096577
	L3D	-1.695361	.8453921	-2.01	0.045	-3.352299	-.0384227
	COMITAX LD	.05382	.0611656	0.88	0.379	-.0660625	.1737024
	L2D	-.0087248	.0355574	-0.25	0.806	-.078416	.0609665
	L3D	-.0419277	.0158527	-2.64	0.008	.0729985	-.0108569
	PETRTAX LD	-.0018151	.0012528	-1.45	0.147	-.0042704	.0006403
	L2D	-.0072608	.0031779	-2.28	0.022	.0134894	-.0010322
	L3D	.0008098	.0010817	0.75	0.454	-.0013102	.0029299
	VALUTAX LD	-.2137798	.2011072	-1.06	0.288	-.6079427	.180383
	L2D	.2130436	.1054337	2.02	0.043	.0063973	.4196899
	L3D	-.4794534	.3363168	-1.43	0.154	1.138622	.1797155
	CUDETAX LD	-.1559	.2511288	-0.62	0.535	-.6481034	.3363034
	L2D	.3879789	.160591	2.42	0.016	.0732264	.7027314
	L3D	-.0010898	.1504547	0.01	0.994	-.2959756	.293796
	CONSTANT	2126.807	3025.893	0.70	0.482	-3803.834	8057.447

Source: Author's computation (2020)

According to VECM rule, the negative values of - Ce1 and – Ce2 showed that there is a long-run relationship among observed variables of the study. From Table 7.1, it showed negative values of - Ce1 and – Ce2 as .901411 and -.0010836 respectively.

These values of - Ce1 and – Ce2 reported the long-run relationship among observed variables. COMITAX had a significant effect on TRANPC in Lag 3(L3D). It was also revealed that PETRTAX significantly influences TRANPC in the long run in Lag 2 (L2D) with z= 2.28 and P>/z/ 0.022. Moreover, in Lag 2 (L2D), VALUTAX positively and significantly influence TRANPC in the long run with z= 2.02 and P>/z/ 0.043. Furthermore, CUDETAX, in Lag2 (LD2), influences TRANPC positively and significantly in the long run with z= 2.42 and P>/z/ 0.016. This advocated the hypothesis that Taxation has a long-run connection with transportation in Nigeria.

Table 8 Johansen Normalization Restriction Imposed

Beta	Coefficient	Std Error	Z	P>|z|	[95% Conf. Interval]	
_ce1						
TRANPC	1	.	.	.		.
COMITAX	.0953243	.0195909	4.87	0.000	.0569269	.1337218
PETRTAX	.0020697	.0006263	3.30	0.000	.0008421	.0032973
VALUTAX	.7033413	.0607603	11.58	0.000	-.8224293	-.5842533
CUDETAX	.5961618	.0263132	22.66	0.000	.5445889	.6477347
-CONS	1689.539	.	.	.		.

Source: Author's computation (2020)

According to Johansen normalization restriction imposed in Table 8, 1% increase in COMITAX increases TRANPC by 0.95% which suggests a positive significant effect COMITAX on TRANPC in the longrun (β=0.953243, t= 4.87, P>|t|=0.000). Furthermore, 1% enhancement in PETRTAX increases TRANPC by 0.002% which advocates significant effect of PETRTAX on TRANPC (β=.0020697, t= 3.30, P>|t|=0.000). 1% enhancement in VALUTAX increases TRANPC by 17.8%. This means VALUTAX imparted TRANPC positively and significantly (β=.7033413, t= 11.58, P>|t|=0.000) in the longrun. This postulates that if VALUTAX increases TRANPC increases. Moreover, 1% increase in CUDETAX increases TRANPC by 0.6%. This reveals a positive significant effect of CUDETAX on TRAPC (β= .5961618, t= 22.66, P>|t|=0.000).

Diagnosis Test

Table 9 Test of Autocorrelation - Lagrange-multiplier test

Lag	Chi2	Df	Prob > chi2	Decision
1	13.8886	25	0.96364	no autocorrelation
2	18.7229	25	0.73926	no autocorrelation
3	22.3107	25	0.61664	no autocorrelation

H0: no autocorrelation at lag order.
Source: Author's computation (2020)

The Lagrange-multiplier test was also carried out to test for autocorrelation. The null hypothesis is that the VECM has no autocorrelation at lag order. But this null hypothesis cannot be rejected because Prob > chi2 of all three lags higher than 0.05. Therefore, all three lags have no autocorrelation as shown in Table 9.

Table 10 Test of Normality - Jarque-Bera test

Equation	Chi2	Df	Prob > chi2	Decision
D_ TRANPC	0.282	2	0.86865	Normally distributed
D_ COMITAX	46.711	2	0.00000	Not normally distributed
D_ PETRTAX	4.083	2	0.12981	Normally distributed
D_ VALUTAX	156.453	2	0.00000	Not normally distributed
D_ CUDETAX	22.652	2	0.00001	Not normally distributed
ALL	3.180	10	0.16023	ALL normally distributed

Source: Author's computation (2020)

Jarque-Bera test was also carried out to detect the normality in the variables. It was shown in Table 10 that errors are normally distributed in D_ TRANPC because Prob > chi2 of 0.86865 is higher than 0.05. But errors are not normally distributed in D_ COMITAX because Prob > chi2 of 0.00000 is lesser than 0.05. Contrarily, errors are normally distributed in D_ PETRTAX because Prob > chi2 of 0.12981 is higher than 0.05. According to the outcome, errors are not normally distributed in D_ VALUTAX and D_ CUDETAX with the value of Prob > chi2 of 0.00000 and 0.00001 respectively. But ALL are normally distributed as a result of Prob > chi2 0.16023 which is higher than 0.05

Table 11 Test of Stability – Eigenvalue stability condition

Eigenvalue	Modulus
1	1
1	1
1	1
1	1
.9354801	.93548
-.9116852	.911685
-.1029108 + .7187648i	.726095
-.1029108 - .7187648i	.726095
-.5410429 + .2957555i	.616603
-.5410429 - .2957555i	.616603
.09676891 + .5724627i	.580584
.09676891 - .5724627i	.580584
.01936053 + .3143913i	.314987
.01936053 - .3143913i	.314987
-.03675046	.03675

The VECM specification imposes 4 unit moduli.

Source: Author's computation (2020)

A stability test was also carried out to discover the stability of the model in Table 11. It was shown in the Table that VECM specification imposed 4 unit moduli which confirmed the stability of the model with the unit value (1) four times both in Eigenvalue and Modulus rows.

Table 12 Granger Causality Wald Tests

Equation	Excluded	chi2	Df	Prob> chi2	Decision
TRANPC	COMITAX	16.977	4	0.000	COMITAX does granger- cause TRANPC
TRANPC	PETRTAX	10.032	4	0.002	PETRTAX does granger - cause TRANPC
TRANPC	VALUTAX	11.203	4	0.000	VALUTAX does granger- cause TRANPC
TRANPC	CUDETAX	58.293	4	0.000	CUDETAX does granger - cause TRANPC
TRANPC	ALL	234.69	16	0.000	ALL jointly do granger cause TRANPC
COMITAX	TRANPC	83.08	4	0.000	TRANPC does granger- cause COMITAX
COMITAX	PETRTAX	98.72	4	0.000	PETRTAX granger - cause COMITAX
COMITAX	VALUTAX	295.38	4	0.000	VALUTAX granger- cause COMITAX
COMITAX	CUDETAX	210.94	4	0.000	CUDETAX granger - cause COMITAX
COMITAX	ALL	1136.6	16	0.000	ALL jointly granger cause COMITAX
PETRTAX	TRANPC	2324.4	4	0.000	TRANPC does granger- cause PETRTAX
PETRTAX	COMITAX	395.9	4	0.000	COMITAX granger - cause PETRTAX
PETRTAX	VALUTAX	14955	4	0.000	VALUTAX granger- cause PETRTAX
PETRTAX	CUDETAX	291.8	4	0.000	CUDETAX granger - cause PETRTAX
PETRTAX	ALL	20935	16	0.000	ALL jointly granger cause PETRTAX
VALUTAX	TRANPC	131.14	4	0.000	TRANPC does granger- cause VALUTAX
VALUTAX	COMITAX	183.18	4	0.000	COMITAX granger - cause VALUTAX
VALUTAX	PETRTAX	184.12	4	0.000	PETRTAX granger - cause VALUTAX
VALUTAX	CUDETAX	657.61	4	0.000	CUDETAX granger- cause VALUTAX
VALUTAX	ALL	1486.1	16	0.000	ALL jointly granger cause VALUTAX
CUDETAX	TRANPC	96.654	4	0.000	TRANPC does granger- cause CUDETAX
CUDETAX	COMITAX	126.66	4	0.000	COMITAX granger - cause CUDETAX
CUDETAX	PETRTAX	201.62	4	0.000	PETRTAX granger - cause CUDETAX
CUDETAX	VALUTAX	3061.4	4	0.000	VALUTAX granger- cause CUDETAX
CUDETAX	ALL	4197.4	16	0.000	ALL jointly granger cause CUDETAX

Source: Author's computation (2020)

Table 12 divulges the causal relationship amid variables observed. It was discovered that all taxation components variables observed showing a causal relationship with TRANPC because Prob> chi2 in the first column of all variables is 0.000 which also below the threshold of determination (0.05). This translates that all the components of taxation granger-cause TRANPC. These are also reciprocated in a second, third, fourth, and fifth column in Table 12, that is TRANPC granger-causes COMITAX, PETRTAX, VALUTAX and CUDETAX because Prob>chi2 is 0.000 which also below the threshold of determination (0.05).

Table 13 Causality Direction amid Taxation and Transportation

Equation	Excluded	chi2	Df	Prob> chi2	Decision
TRANPC	COMITAX	16.977	4	0.000	COMITAX does granger- cause TRANPC
COMITAX	TRANPC	83.08	4	0.000	TRANPC does granger cause COMITAX
TRANPC	PETRTAX	10.032	4	0.002	PETRTAX does granger - cause TRANPC
PETRTAX	TRANPC	2324.4	4	0.000	TRANPC does granger- cause PETRTAX
TRANPC	VALUTAX	11.203	4	0.000	VALUTAX does granger- cause TRANPC
VALUTAX	TRANPC	131.14	4	0.000	TRANPC does granger- cause VALUTAX
TRANPC	CUDETAX	58.293	4	0.000	CUDETAX does granger - cause TRANPC
CUDETAX	TRANPC	96.654	4	0.000	TRANPC does granger- cause CUDETAX

Source: Author's computation (2020)

Table 13 opines the direction of causality among variables observed. It shows that COMITAX leads to the existence of TRANPC, and TRANPC also ignites COMITAX, this explains that COMITAX is formulated to establish TRANPC, and TRANPC is also established to generate COMITAX. It also shows bi-directional causality between TRANPC and COMITAX. This decision is taken because Prob> chi2 is 0.000 which below 0.05. PETRTAX led to TRANPC, and TRANPC was also established to generate PETRTAX, this is also bidirectional causality. More so, VALUTAX and CUDETAX also possess bi-directional causality with TRANPC because Prob> chi2 of 0.000 which below 0.05. This negates the null hypothesis and embraces an alternative hypothesis that predicted a causal relationship between taxation and transportation. The direction of causality is strong and bidirectional.

4.2. Discussion of Findings

This study gauges taxation's effect on transportation from 1981 to 2019 in Nigeria. It is revealed after enormous analysis that COMITAX significantly influences transportation both in the long run and short run. Also, both COMITAX and TRANPC show bi-directional causality. This further translates that COMITAX ignites TRANPC and vice versa. The policy implication is that the incomes realize from this component of taxation provide support on TRANPC in Nigeria. Also, PETRTAX influences TRANPC positively both in the short run and long run in Nigeria, this further exposes that PETRTAX stands as the prerequisite and essentiality for the enhancement of transportation in the country. The income aggregated from PETRTAX increases transportation in the country. More so, VALUTAX and CUDETAX have a positive influence both in the short run and long run. That is VALUTAX and CUDETAX which are indirect taxes support the essentiality of TRANPC. VALUTAX and CUDETAX are also germane in the

provision of transportation in the country. Income realized from these taxation components has been assisting the government in the maintenance, provision of automobiles, buses, bicycles, trains, helicopters, trucks, watercraft, aircraft and spacecraft. It is because of this transportation among others that taxation has been forcefully collected from the income of the individual and private organization. This shows that taxation incomes granger-causes transportation as supported by Agbigbe (2016), and Ajitoye et al (2018). This opines vividly that an increment in taxation revenue enhances the accessibility of government to resources to cater for government expenditure on transportation, and motivates taxpayers for tax fulfillments as also concurred by Adegbite and Fasina (2019).

5. Conclusions

This study gauges taxation's effect on transportation from 1981 to 2019 in Nigeria. This study further assesses the bearing of causality among TRANPC, COMITAX, PETRTAX, VALUTAX, and CUDETAX. Time series analytical tools such as VECM, Johnson Test for Cointegration, Vector Autoregression and granger causality Wald (GCW) test are adopted for analysis. Diagnosis tests such as the Lagrange-multiplier test, Jarque-Bera test and Eigenvalue stability condition are also carried out to examine autocorrelation, stability and normality tests respectively. The outcome divulges that COMITAX has a positive short-run and long-run influence on transportation. PETRTAX, VALUTAX and CUDETAX also impact transportation significantly both in the long run and short run as obviously deduced from empirical analysis. This reveals that all the components of taxation observed influence transportation positively both in the long run and short run in Nigeria. Conclusively, taxation impacts transportation positively and significantly both in the short run and long run. This translates that taxation income has been utilized to upsurge transportation in Nigeria. It is predicted that transportation will perform excellently more than this in terms of economic development, and employment generation if taxable income is properly monitored and utilized effectively. Effective transportation enhances, increases, and promotes business connections within the economy and beyond.

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Author's Contributions

The author conceived the study, did the literature review section and was responsible for the design, data collection, data analysis and interpretation.

Disclosure Statement

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