A Tado-Yamamoto Granger-Non-Causality Approach to the Impact of Taxation on Infrastructural Development in Nigeria.

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ABSTRACT

This study assessed the impact of taxation on infrastructural development in Nigeria using the Tado-Yamamoto Granger-Non causality approach. Time series data on Capital Gain Tax (CGT), Withholding Tax (WHT), Stamp Duty (SDY), and Infrastructural Development (IND) spanning from 2000 to 2024 elicited from the data banks of Federal Inland Revenue Service, the Central Bank of Nigeria, and National Bureau of Statistics was used for this study. The Augmented Dickey-Fuller test was used to establish stationarity at first and second difference, making the series suitable for the Tado-Yamamoto model after the serial LM test showed no evidence of autocorrelation in the model. The result aligns with the a priori expectation as CGT (β= 3.333148), WHT (β= 0.303194), and SDY (β= 1.508161) exerted a positive but statistically insignificant impact on infrastructural development in Nigeria. In furtherance, the result of the impulse response showed a minimal long-run reaction of IND to the predictors. Also, this study found that IND is strongly endogenous both in the short and long run, as determined by the variance decomposition. Diagnostic test of inverse roots showed stability in the parameter estimate, implying that the estimated parameters are stable over time. In line with the findings, this study concluded that for the period under review, taxation did not impact significantly on infrastructural development in Nigeria, and as a result recommended the need for a paradigm towards effective tax policy incorporating CGT, WHT, and SDY by the Federal Inland Revenue Service rather than the prevailing undue emphasis on tax yield from the oil sector, personal income tax, and company income tax. Also, the Nigerian government can optimize tax yield and infrastructural development by revamping the postal service to incorporate the vast benefits of the growing e-delivery market in Nigeria.

Keywords: Benefit-Received Theory, Infrastructural Development, Tado-Yamamoto Model, Taxation.

INTRODUCTION

Taxation in its earliest form revolved around income tax raised for military expenditure by monarchs. It is the process through which governments impose a compulsory levy on citizens to raise funds for public expenditures. In contemporary times, taxes are raised to meet various public expenditures, primarily infrastructural development. This stems from the bi-directional relationship between tax revenue and infrastructural development, as improved tax revenue provides the funds needed for infrastructural development, while improved infrastructural development in turn creates an enabling environment for viable businesses and improved tax yield. Nonetheless, Nigeria's tax-to-GDP ratio (6.7% tax-to-GDP) has remained persistently lower than the 15.6% average in Africa and the 34.1% OECD average in 2021 (OECD, 2023). Due to the limited tax revenue yield, its percentage of tax revenue to infrastructural development has remained relatively low, spurring a systemic infrastructural expectation gap (IEG). IEG is the divergence between societal anticipations regarding infrastructure services (including transportation networks, electrical supply, water provision, healthcare systems, and educational institutions) and the actual standard of infrastructure delivered by governmental bodies or regulatory authorities.

The reasons for Nigeria's widened IEG are not unconnected with fiscal indiscipline, unscrupulous activities of

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tax officers, policy inconsistency, and inappropriate fiscal policies with a daunting effect on small-scale businesses. In terms of inappropriate fiscal policies, the recent electricity price hike by almost 100% to ₦62/68 per kilowatt-hour (kWh) in 2020 with a further 300% hike to ₦225 kWh for B and A customers in 2024 and the increase in the price of premium motor spirit (PMS) by about 10% (₦160 in 2020) with a further increase to ₦1,030 per liter in October 2024 (Adenekan, 2020; Proshare, 2024; Mosadioluwa, 2024), all have a daunting effect of the Nigerian economy. The resultant effect of the expansionary fiscal policies has also led to the exit of multinational companies to neighboring countries in 2024. All these limits the potency of taxation as a measure to improve infrastructural development and economic growth. Consequently, Nigeria's infrastructure remains decrepit and the sixth most inadequate in Africa as over 63% of the 200,000 kilometers of roadways across Nigeria's 922,768 square kilometers remain in a state of disrepair (Punch, 2023). Amidst the various policy measures in the energy sector such as the Sustainable Power and Irrigation Initiative, the Renewable Energy Scale-up Project, the Power Sector Recovery Performance-Based Operation, the Core North Regional Power Interconnector, and the Nigerian Electricity Transmission Project, which collectively attracted US$4.36 billion expenditure predominantly financed through approximately ten loans from the World Bank over the past decade, only 60.5% of the Nigerian population has access to electricity, coupled with a systemic failure of the national grid occurring up to 105 times between June 2015 and October 2024 (World Bank, 2023; Tunji & Olawin, 2024).

In view of the weak infrastructure in Nigeria despite the aforementioned policy measures, with a dearth of literature assessing taxation from the perspectives of capital gains tax (CGT), withholding tax (WHT), and stamp duties (SDY), this study was motivated to assess the impact of taxation on infrastructural development in Nigeria, prioritizing CGT, WHT, and SDY in Nigeria for the period 2000 to 2024 using Tado-Yamaoto (1995) Granger non-causality approach.

LITERATURE REVIEW

In his seminar work, 'The Wealth of Nations', Adam Smith (1776), sees taxation as the contribution of citizens to the government that ought to be levied in proportion to their respective abilities. This definition emphasized the canon of equity and fairness in the tax process, meaning that the burden of tax should reflect the capacity of taxpayers to pay the tax, but failed to see tax as a compulsory levy imposed by the government. Thus, taxation is broadly seen as the process through which the government imposes a compulsory levy commiserating with the income of the citizens and institutions to meet public expenditures and to provide basic societal needs and social optimum. It includes the various forms such as CGT, WHT, and SDY. Capital Gain Tax is a compulsory levy imposed on profits realized from the sale or exchange of a capital asset (Zodrow, 1995). Also, it is the revenue yield from a compulsory fee, usually 10% in Nigeria, imposed on the sale of assets by the government to meet its expenditure and the provision of social welfare to the citizens. WHT, according to McGee (2004), is a mechanism by which the government requires the payer of income (such as wages, dividends, or interest) to deduct tax at the time of payment and remit it to the government. Similarly, WHT is a compulsory income chargeable by the payer of income (wages, dividends, interest, and royalties) on behalf of the tax authority to enhance efficiency in revenue yield and, principally, to prevent tax evasion. Stamp duties are taxes imposed on documents or papers, required to make them legally enforceable, covering transactions such as property transfers, agreements, and financial instruments (Chisholm, 1911). Infrastructural development is the aggregate of the facilities and social amenities that are provided to enhance the standard of living of the citizenry (Inyiama et al., 2017). Similarly, infrastructural development is the provision of essential facilities and services required to support economic growth, including transport, energy, water supply, sanitation, and telecommunications (World Bank, 1994). Accordingly, infrastructural development entails the establishment and enhancement of essential physical and institutional systems, such as transportation, communication, energy, water supply, and social facilities needed to enhance economic growth and the overall quality of life.

Theoretical Framework

The Benefit-Received Theory, originally attributed to Adam Smith in the 17th century and subsequently expanded upon by John Locke (1970), along with proponents such as Knut Wicksell and Erik Lindahl, constitutes the theoretical framework for this study. This theory asserts that taxpayers should pay taxes in proportion to the benefits they receive from government services. It holds that the revenues generated from compulsory levies imposed by the government on its citizens should be allocated to augment the welfare and

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well-being of the populace. This further demonstrates that utility must be derived from the services rendered in exchange for the contributions made by individuals and the private sector to the governmental treasury.

The theory faces criticism on the basis that certain goods, such as ambient air, national security, and infrastructure, are non-excludable and unquantifiable, thereby complicating the measurement or allocation of the precise benefits that each individual obtains from such services (Musgrave & Musgrave, 1989). Nevertheless, the theory is particularly applicable to the study as it provides taxpayers with essential information and a framework to hold government authorities accountable for contributions to the public treasury. Likewise, the theory serves as a crucial insight for the public, enabling them to scrutinize and monitor tax revenues and their utilization in Nigeria, a context where tax rates and yields have experienced systemic increases without a commensurate advancement in infrastructural development and social welfare within Nigerian communities.

EMPIRICAL REVIEW

There is a systemic increase in empirical inquiries on the nexus of taxation and infrastructural development, incorporating the benefit-received principle to optimize the social optimum and improve tax yield. Specifically, a study by Adegbite (2021) utilized the Vector Autoregression, and Granger Causality Wald (GCW) approach with variables such as company income tax (COMITAX), petroleum profit tax (PETRTAX), value added tax (VALUTAX), custom and excise duties (CUDETAX), and expenditure on transportation (TRANPC) to examine the nexus of taxation and transportation in Nigeria spanning from 1981 to 2019. The study found a statistically significant positive impact of taxation (all the predictors) on transportation, both in the long and short run, in Nigeria. However, the study, which calls for effective tax revenue utilization to optimize transportation networks with a positive ripple effect on the Nigerian economy, failed to estimate vital diagnostic tests such as impulse response and variance decomposition relevant to ascertaining the influence of innovation and a one-standard-deviation shock among the variables in the model.

In an extension of the nexus of taxation and infrastructural development, Yoshino and Abidhajaev (2017) used the difference-in-difference method to assess the impact of infrastructure on tax revenue: Case study of high-speed train in Japan. The Kyushu high-speed rail, constructed between 1991 and 2003, with operation commencing in 2004, formed the basis for the study. It was revealed that the construction phase saw an uptake in tax remittance, with a further statistically significant positive impact on tax revenue yield when the high-speed rail line was connected to major cities such as Osaka and Japan. The study recommends the need for improved infrastructure financing from long-term investors such as pension funds and insurance companies to optimize the tax revenue yield, which exerts positive externalities and economic development, as increasingly utilized in the US.

At the state level, Ade and Festus (2020) studied personal income tax and infrastructural development in Lagos State, Nigeria, using ex-post facto research design and annual time series data on variables such as expenditure of government on housing (EDH) and expenditure of government on road (EDR) as proxies for infrastructural development and personal income tax (PIT) for the period 1997 to 2018. The result of the ADF and PP unit root test showed a mixed order of integration with the F-bound co-integration result, establishing a long-run relationship in the study. Although the study stated that it relied on the Static Panel Model, which is grossly inadequate for the time series data, the ARDL was estimated to show an insignificant positive impact of PIT on EDH with a speed of adjustment of 41.33% to address disequilibrium in the model. On the other hand, a statistically insignificant negative impact of PIT on EDR was established with a speed of adjustment in disequilibrium by 96.97%. Diagnostic tests such as normality, serial correlation, and heteroskedasticity were all statistically insignificant to uphold the classical assumptions of normality, no autocorrelation, and homoscedasticity, respectively. The study recommends the need for effective public expenditure across relevant sectors to enhance even infrastructural development in the state.

In congruence, Batu (2021) evaluated the impact of internally generated revenue on infrastructural development in Benue State using annual time series data on variables such as Personal Income Tax (PIT), Withholding Tax (WHT), Road Tax (ROT), Returns on Government Investments (RGI), and Infrastructural Development (INFRADEV) for the period 2000 to 2019. In line with the single order of integration [$I(1)$] with no evidence of co-integration, the unrestricted Vector Autoregressive (VAR) was used as a method of analysis to show a

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significant positive impact of PIT on INFRDEV and a non-significant positive impact of WHT on INFRADEV. On the other hand, ROT and RGI exerted an insignificant negative impact on INFRADEV in Benue State. Diagnostic tests such as impulse response and variance decomposition were carried out to assess the innovations and shocks in the study. The study recommends, among others, that the Benue State Government should resuscitate abandoned industries and expand investment portfolios to increase Internally Generated Revenue in the state.

Muojekwu and Udeh (2023) examined the effect of tax revenue on infrastructural development in Nigeria with annual time series data on petroleum profit tax (PPT), company income tax (CIT), value-added tax (VAT), custom and exercise duties (CED), and capital expenditure (CAPEX) for the period 1992 to 2021. Despite that the ADF unit root showed integration at first difference [$I(1)$] across the variables, OLS was used as an analytical technique against a more suitable technique like VAR to show a significant positive effect of all the predictors (PPT, CIT, VAT and CED) on infrastructural development in Nigeria. The study, however, failed to perform a co-integration test and relevant post-estimation tests, implying that the OLS assumptions may have been violated in the study. It recommends adequate utilization of tax revenue by the Nigerian government to enhance infrastructural development in the country.

In a study, causality analysis of non-oil tax component of government revenue, company income and transaction taxes: Evidence from a third world country, Ebiaghan, Jeroh and Ideh (2021) used company income tax (CIT) and stamp duty (SD) as explanatory variables to infer their impact on federal non-oil internal revenue (IGR) for the period 2000 to 2015. Against the mixed order of integration, the study used OLS and autoregressive techniques (the former unsuitable) to show a significant positive impact of CIT and SD on IGR in Nigeria. The study failed to perform diagnostic tests that are relevant to its validity. It recommends that tax holidays should be marginally reduced by the Federal Government to enhance non-oil tax remittance from company Income tax.

In contrast to the result, Jones (2022) assessed the relationship between stamp duty and economic growth in Nigeria to find a significant negative impact of stamp duty on economic growth in Nigeria. The study performed the long-run ARDL without checking the precondition of co-integration and also failed to estimate ECM, which is useful in correcting disequilibrium in an ARDL technique. Similarly, diagnostic tests were ignored in the study, implying that the study may have violated the OLS assumptions. More poignant was the mixed order of integration [$I(1)/I(2)$], which requires a robust technique such as the Tado-Yamamoto (1995) approach than the ARDL estimated in the study. It recommends that the government strengthen public institutions and provide robust government investment as a source of domestic revenue produced by various business operations.

Osho, Adeseyoju and Idowu (2019) investigated the impact of capital gain tax on investment, infrastructural facilities provision, and gross domestic product in Nigeria using the OLS technique despite the mixed integration [$I(0)$-$I(2)$] established by the ADF test. The result showed a statistically significant positive impact of capital gain tax on investment, infrastructural provision, and economic growth. It failed to perform diagnostic tests and recommends the need for effective administration of capital gain tax with adequate utilization of the yield to enhance maximum social welfare.

METHODOLOGY

The study adopted an ex-post facto research design. Ex-post facto research is after-the-fact research, where the research centers on a phenomenon or event that has already taken place. Annual time series data on IND, CGT, WHT, and SDY retrieved from the data bank of the Central Bank of Nigeria (CBN) and National Bureau of Statistics (NBS) spanning from 2000 to 2024 were used for this study. The scope is considered for the study due to relevant policies such as the 0.375% stamp duties rate chargeable on securities by banks, the new deduction of tax at source (WHT) regulations 2024, the Joint Tax Board (Awujoola & Adekoya, 2024), and the proposed tax reform by the administration of President Tinubu in 2024 which are positioned to exert predictive influence on the outcome variable, and the reaction of the outcome variable to a one standard deviation shock by the predictors richly captured by the Tada-Yamamoto (1995) granger non-causality approach.

The Tado-Yamamoto (TY) non-Causality approach, developed in 1995 by Tado-Yamamoto was used as the analytical technique to infer the predictive influence of CGT, WHT, and SDY on IND in Nigeria. TY is an

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approach that augments the VAR model with $k+d_{max}$ by generating the asymptotic VAR statistics in the form of Chi-square ($\chi 2$) distribution rather than the F-statistics used in the traditional Granger-causality approach (Khan, 2019; Ezie & Ezie, 2021). TY, as a robust technique, came to the fore to handle the drawbacks of the traditional Granger causality in dealing with structural break (Edward, 2023). It is a flexible technique with no emphasis on co-integration test and can be estimated regardless of the order of integration [$I(0)$, $I(1)$, $I(2)$], thus reducing the bias associated with unit root and co-integration tests. The model follows;

$k + d_{max}$ - - - - - - - - - - 1.1

Where k = optimal lag length and d_{max} is the maximum order of integration. By augmenting equation 1.1 with the variables under investigation using the traditional VAR model, a 4 x 4 matrix was developed as follows;

$$IND_t = a_{0+} + \sum_i^k \alpha_{1i} IND_{t-i} + \sum_i^k a_{2i} CGT_{t-i} + \sum_i^k a_{3i} WHT_{t-i} + \sum_i^k a_{4i} SDY_{t-i} + \sum_j^{k+dmax} \beta_{1j} IND_{t-j} + \sum_j^{k+dmax} \beta_{2j} CGT_{t-j} + \sum_j^{k+dmax} \beta_{3i} WHT_{t-j} + \sum_j^{k+dmax} \beta_{4j} SDY_{t-i} + \varepsilon_{1t} \quad - \quad - \quad 1.2$$

$$CGT_t = \theta_{0+} + \sum_i^k \theta_{1i} IND_{t-i} + \sum_i^k \theta_{2i} CGT_{t-i} + \sum_i^k \theta_{3i} WHT_{t-i} + \sum_i^k a_{4i} SDY_{t-i} + \sum_j^{k+dmax} \varphi_{1j} IND_{t-j} + \sum_j^{k+dmax} \varphi_{2j} CGT_{t-j} + \sum_j^{k+dmax} \varphi_{3i} WHT_{t-j} + \sum_j^{k+dmax} \varphi_{4j} SDY_{t-i} + \varepsilon_{2t} \quad - \quad - \quad 1.3$$

$$WHT_t = \gamma_{0+} + \sum_i^k \gamma_{1i} IND_{t-i} + \sum_i^k \gamma_{2i} CGT_{t-i} + \sum_i^k \gamma_{3i} WHT_{t-i} + \sum_i^k \gamma_{4i} SDY_{t-i} + \sum_j^{k+dmax} \delta_{1j} IND_{t-j} + \sum_j^{k+dmax} \delta_{2j} CGT_{t-j} + \sum_j^{k+dmax} \delta_{3i} WHT_{t-j} + \sum_j^{k+dmax} \delta_{4j} SDY_{t-i} + \varepsilon_{3t} \quad - \quad - \quad 1.4$$

$$SDY_t = \pi_{0+} + \sum_i^k \pi_{1i} IND_{t-i} + \sum_i^k \pi_{2i} CGT_{t-i} + \sum_i^k \pi_{3i} WHT_{t-i} + \sum_i^k \pi_{4i} SDY_{t-i} + \sum_j^{k+dmax} \psi_{1j} IND_{t-j} + \sum_j^{k+dmax} \psi_{2j} CGT_{t-j} + \sum_j^{k+dmax} \psi_{3i} WHT_{t-j} + \sum_j^{k+dmax} \psi_{4j} SDY_{t-i} + \varepsilon_{4t} \quad - \quad - \quad 1.5$$

Where

K = lag length (1 selected by FPE and other criterion in Table 1.2)

$d_{max} = 2$ (max order of integration in Table 1.1)

$a_0\ \theta_0\ \gamma_0\ \pi_0$ are the intercepts in equations 1.2 to 1.5.

From equations 1.2 to 1.5, it is expected that the coefficients are positive as an increase is CGT, WHT, and SDY will correlate positively with infrastructural development in Nigeria. Thus, $\alpha_{1i} - {}_{4j} > 0$ in equation 1.2. From 1.3, $\theta_{1i} - \varphi_{4j} > 0$. $\gamma_{1i} - \delta_{4j} > 0$ in equation 1.4 and so is $\pi_{1i} - \psi_{4j4j} > 0$ in equation 1.5.

Performing a time series analysis requires relevant pre-estimation tests such as unit root and co-integration to ascertain the stationarity and evidence of long-run relationship, respectively. Notwithstanding, the Tado-Yamamoto approach employed in this study pays little attention to these tests, primarily co-integration. However, the unit root test using the Augmented Dickey-Fuller (ADF) is relevant to know the level of integration of the series. A unit root is a statistical test used to determine whether a time series of data is stationary or non-stationary. Stationarity means that the statistical properties of a series (such as mean, variance, and autocorrelation) do not change over time. It is performed under the null hypothesis that there is a unit root, which is rejected when the p-value is less than the selected threshold of 0.05, or otherwise, accepts **H_0** when the p-value is greater than 0.05 and concludes that there is a unit root. A useful pre-estimation test in the Tado-Yamamoto approach is lag selection using the d_{max}. Lag selection criteria encompass a variety of sophisticated methodologies that primarily identify the specific lag length that effectively minimizes the error associated with the model while simultaneously maximizing its predictive accuracy and forecasting performance. The goal is to find the lag length that minimizes the model's error and maximizes its forecasting accuracy using criterion such as Akaike Information Criterion (AIC) (Akaike, 1974), Bayesian Information Criterion (BIC) (Schwarz, 1978), Hannan-Quinn Information Criterion (HQIC) (Hannan & Quinn, 1979), Partial Autocorrelation Function (PACF), Final Prediction Error (FPE), and Autocorrelation Function (ACF). The decision-making rule is to select the criterion with the smallest value, which ensures the model's stability while enhancing the predictive capacity of the model.

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In furtherance, it is pertinent to perform post-estimation tests such as stability; impulse response factor (IRF); and variance decomposition in the TY approach. The IRFs show the effects of shocks on the adjustment path of the variables in the VAR model as it traces the effect of a one standard deviation shock on the current and future values of the endogenous variables (Ezie & Ezie, 2021). Variance decomposition measures how much of a change in a variable is due to its own shock, as well as changes due to shocks by other variables in the system. In variance decomposition, a variable is strongly endogenous if it reacts greatly to its own innovation than to innovations introduced by other variables in the system.

DISCUSSION OF RESULTS

Table 1.1: ADF unit root test

ADF test	ADF test			Remark
Variables	Adjusted t-test	p-value	Order Integration	Stationary
IND	-3.632896	0.0000***	I(2)	Stationary
CGT	-3.644963	0.0011***	I(1)	Stationary
WHT	-3.632896	0.000***	I(1)	Stationary
SDY	-3.632896	0.0005***	I(1)	Stationary

Source: Authors computation using Eviews 12 (2024)

Legend: * ** significant

From Table 1.1, it is observed that the series are integrated of mixed order (order 1 and 2), making the integration suitable for the Tado-Yamamoto approach. The result implies that though the series were non-stationary at level but by performing the ADF test, IND became stationary at *I*(2), with the remaining series (CGT, WHT, and SDY) becoming stationary at first difference *I*(1). This means that d_{max} (maximum order of integration) for the study is 2.

Table 1.2: Lag Selection Result (d_{max})

VAR Lag Order Selection Criteria						
Endogenous variables: IND CGT WHT SDY						
Exogenous variables: C						
Date: 11/15/24 Time: 22:36						
Sample: 2000 2024						
Included observations: 23						
Lag	LogL	LR	FPE	AIC	SC	HQ
0	-1710.019	NA	6.31e+59	149.0452	149.2426	149.0948
1	-1672.842	58.19116*	1.03e+59*	147.2036*	148.1910*	147.4519*
2	-1658.121	17.92143	1.33e+59	147.3148	149.0921	147.7618
* indicates lag order selected by the criterion						
LR: sequential modified LR test statistic (each test at 5% level)						

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FPE: Final prediction error				
AIC: Akaike information criterion				
SC: Schwarz information criterion				
HQ: Hannan-Quinn information criterion				

Source: Author's computation using Eviews 12 (2024)

From Table 1.2, since FPE is the criterion with the smallest value (1.03e+59), it was concluded that lag one is the optimal lag that balances the fit and complexity in the model. In addition, all the criteria selected lag one, implying the suitability of lag one in minimizing the errors in the model. Summarily, the result suggests that k (lag length) for the study is 1. Using the $k + d_{max}$ approach with $k = 1$ and $d_{max} = 2$, lag 3 formed the optimal lag for the study.

Table 1.3: Autocorrelation Test Result

VAR Residual Serial Correlation LM Tests						
Date: 11/16/24 Time: 08:36						
Sample: 2000 2024						
Included observations: 22						
Null hypothesis: No serial correlation at lag h						
Lag	LRE* stat	Df	Prob.	Rao F-stat	Df	Prob.
1	11.43903	16	0.7816	0.547436	(16, 6.7)	0.8479
2	25.55524	16	0.0606	2.284309	(16, 6.7)	0.1407
3	10.95290	16	0.8124	0.513765	(16, 6.7)	0.8706
Null hypothesis: No serial correlation at lags 1 to h						
Lag	LRE* stat	Df	Prob.	Rao F-stat	Df	Prob.
1	11.43903	16	0.7816	0.547436	(16, 6.7)	0.8479
2	296.1381	32	0.0000	NA	(32, NA)	NA
3	NA	48	NA	NA	(48, NA)	NA
*Edgeworth expansion corrected likelihood ratio statistic.						

Source: Author's computation using Eviews 12 (2024)

Autocorrelation forms a major precondition for the estimation of the TY model, and the result observed in Table 1.3 suggests that the p-values are statistically insignificant (greater than 0.05) to indicating that the error term across different periods does not correlate in the study. In other words, the p-values suggest that there is no evidence of autocorrelation in the study, making the series suitable for the TY approach.

Table 1.4: Estimation Result

VAR Granger Causality/Block Exogeneity Wald Tests		
Date: 11/16/24 Time: 08:31		
Sample: 2000 2024		

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Included observations: 22			
Dependent variable: IND			
Excluded	Chi-sq	Df	Prob.
CGT	3.333148	3	0.3431
WHT	0.303194	3	0.9594
SDY	1.508161	3	0.6804
All	10.66494	9	0.2994
Dependent variable: CGT			
Excluded	Chi-sq	Df	Prob.
IND	18.78732	3	0.0003
WHT	3.186486	3	0.3638
SDY	6.706900	3	0.0819
All	32.74227	9	0.0001
Dependent variable: WHT			
Excluded	Chi-sq	Df	Prob.
IND	2.224761	3	0.5271
CGT	5.880552	3	0.1176
SDY	2.475568	3	0.4797
All	11.03102	9	0.2736
Dependent variable: SDY			
Excluded	Chi-sq	df	Prob.
IND	0.623889	3	0.8909
CGT	1.387101	3	0.7086
WHT	3.418064	3	0.3315
All	4.468284	9	0.8780

Source: Author's computation using Eviews 12 (2024)

For convenience, equation 1.2 ($IND_t = a_{0+} + \sum_i^k \alpha_{1i} IND_{t-i} + \sum_i^k a_{2i} CGT_{t-i} + \sum_i^k a_{3i} WHT_{t-i} + \sum_i^k a_{4i} SDY_{t-i} + \sum_j^{k+dmax} \beta_{1j} IND_{t-j} + \sum_j^{k+dmax} \beta_{2j} CGT_{t-j} + \sum_j^{k+dmax} \beta_{3i} WHT_{t-j} + \sum_j^{k+dmax} \beta_{4j} SDY_{t-i} + \varepsilon_{1t}$) with IND as the outcome variable is interpreted in this study. Also, it is noteworthy that the VAR estimation with d_{max} was not presented as the Tado-Yamamoto (1995) approach prioritized the asymptotic $\chi 2$ wald test in Table 1.4. It is observed from Table 1.4 that the $\chi 2$ (3.333148, 0.303194, and 1508161) are theoretically plausible but statistically insignificant in predicting their future influence on infrastructural development in Nigeria. Specifically, CGT exerts a 333% influence on IND, but the p-value (0.341, which is > 0.05) is an indication that the null hypothesis of no significant predictive influence of CGT on IND cannot be rejected. Similarly, the p-values of WHT and SDY (0.9594 and 0.6804, respectively) are greater than 0.05, implying the failure to reject the null hypotheses. Consequently, the overall result with a p-value (0.2994) suggests that taxation (CGT, WHT, and SDY) does not impact significantly on infrastructural development in Nigeria.

The implication of the result is that taxation as a fiscal measure has no significant impact on infrastructural development in Nigeria. From the specific results of $\chi 2$ for CGT, WHT, and SDY (3.333148, 0.303194, and

1508161) with their p-values (0.3431, 0.9594, and 0.6804, respectively), all the explanatory variables are theoretically plausible but statistically insignificant in predicting the variation in IND in Nigeria. The result is consistent with Batu (2021), which found a no significant positive impact of WHT on IND in Benue State, Nigeria. The findings indicate that WHT, though a potentially effective tool for promoting transparency and fiscal efficiency, needs to be sufficiently leveraged to improve tax remittance and support infrastructural development in Nigeria. If the trend continues without adequate policy measures, IND will react negatively to a one standard deviation shock from WHT in the long run (Figure 1.2) and continue the insignificant influence (1.46% in Table 1.5) on IND in the long run. This result has informed policymakers and tax authorities in Nigeria on the need for adequate utilization of WHT tax to enhance tax remittance accruing from income payment on dividends, interest, wages, and royalties in Nigeria to optimize infrastructural development.

Similarly, the result of an insignificant positive impact of CGT on IND was validated by Osho et al. (2019), who empirically found a statistically insignificant positive impact of CGT on infrastructural provision in Nigeria. Accordingly, the result in Figure 1.2 showed a minimal positive reaction of IND to a one innovation shock introduced by CGT in the long run, with a minimal influence (3.58% in period 2 and 7.36% in period 3 in Table 1.5) of CGT on IND in the long run. This has informed policymakers on the need for a paradigm in policy measures towards tax revenue from the sale of assets rather than the undue reliance on PIT, PPT, and CIT, which have not addressed the infrastructural expectation gap in Nigeria.

In contrast to a no significant positive impact of SDY on IND in Nigeria established in the study, Jones (2022) found a significant negative impact of stamp duty on economic growth in Nigeria. Gleaning from Figure 1.2, IND will react minimally but positively to a one innovation shock by SDY in the long run, as well as a minimal 4.09% influence in the long run. This result has informed the Nigerian government of the need to revamp the postal service, which will enhance remittance from the emerging e-delivery market and the country's infrastructural development.

Diagnostic Tests

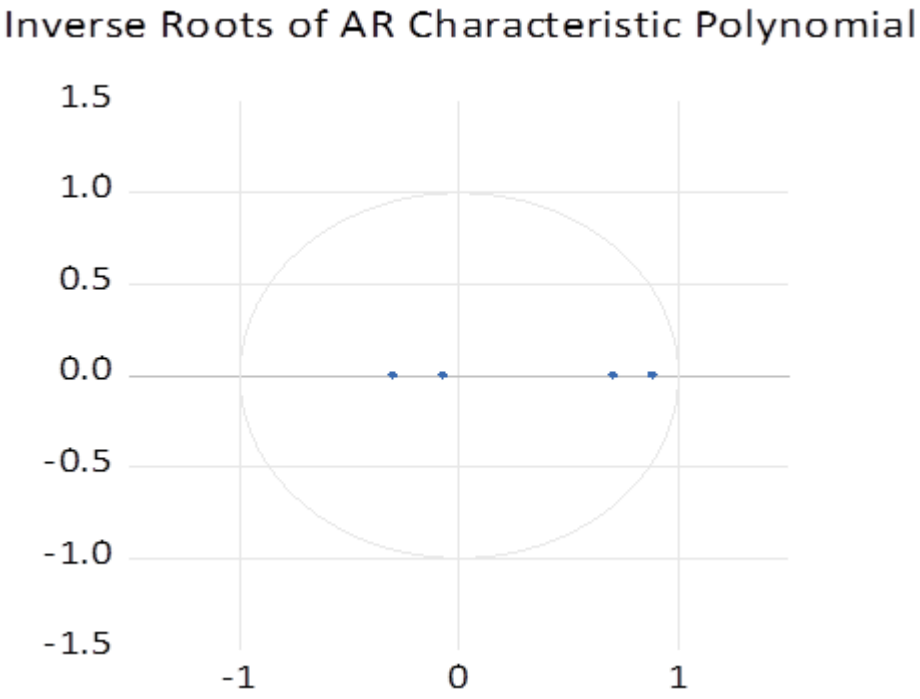

Figure 4.1: Stability Test

Source: Author's computation using Eviews 12 (2024)

From Figure 1.1, it is observed that none of the modulus fell outside the unit circle. As such, the null hypothesis that the VAR estimate is stable over time is accepted, and the alternative hypothesis is rejected. In line with the result, this study concluded that the model's parameters are stable over time.

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Impulse response

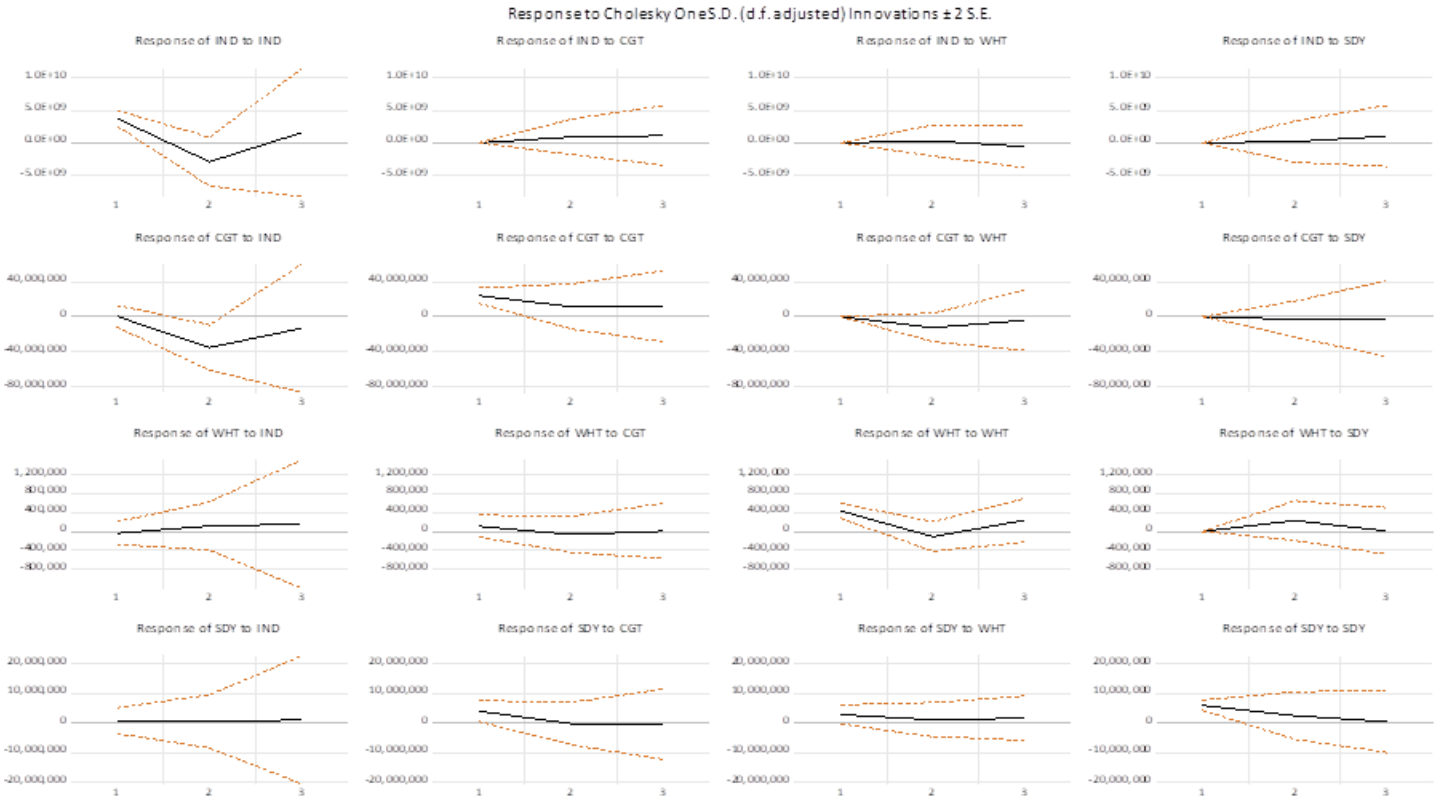

Figure 1.2: Impulse Response Result

Source: Author's computation using Eviews 12 (2024)

For convenience, the impulse response in line with equation 1.2 was interpreted for this study as it stresses the reaction of IND to a one standard deviation shock by the predictors in the model. It is observed that a one standard deviation shock by IND led to a significant decline from the steady state towards period 2, suggesting a negative reaction. Contrary, the one standard deviation shock on itself led to a positive movement above the steady state through period 3 up to the next policy regime. The reaction of IND to a one standard deviation shock by CGT is relatively stable above the steady state from period 1 through period three up to the next policy regime. The reaction of IND to one innovation shock by WHT in periods 1 to 2 is stable at the steady state but declines minimally from the steady state through period three up to the next policy regime. On the other hand, IND moves steadily on the steady state due to one innovation shock by SDY in period 1, followed by a minimal zigzag uptick through period e until the next policy regime.

Table 1.5: Variance Decomposition Result

Variance Decomposition of IND:					
Period	S.E.	IND	CGT	WHT	SDY
1	3.77E+09	100.0000	0.000000	0.000000	0.000000
		(0.00000)	(0.00000)	(0.00000)	(0.00000)
2	4.86E+09	95.75960	3.581242	0.503278	0.155877
		(16.4053)	(12.0366)	(6.09010)	(9.75584)
3	5.37E+09	87.07059	7.368914	1.469518	4.090983
		(17.1202)	(12.0767)	(9.07353)	(10.2076)

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Variance Decomposition of CGT:					
Period	S.E.	IND	CGT	WHT	SDY
1	24109119	0.025352	99.97465	0.000000	0.000000
		(7.97741)	(7.97741)	(0.00000)	(0.00000)
2	46060126	58.62860	33.84453	7.136387	0.390478
		(20.2019)	(17.4655)	(8.05502)	(4.30082)
3	49571761	57.92782	34.68991	6.851146	0.531124
		(18.4742)	(16.2067)	(8.62688)	(8.31312)
Variance Decomposition of WHT:					
Period	S.E.	IND	CGT	WHT	SDY
1	447669.0	0.712783	5.957725	93.32949	0.000000
		(6.52826)	(10.1707)	(11.4704)	(0.00000)
2	530245.0	5.089581	5.747479	70.76259	18.40035
		(12.5079)	(11.4591)	(16.2103)	(16.2238)
3	599427.3	10.47064	4.503817	70.61114	14.41440
		(21.3567)	(9.64049)	(16.7040)	(14.2761)
Variance Decomposition of SDY:					
Period	S.E.	IND	CGT	WHT	SDY
1	7872291.	1.138486	27.00784	13.74965	58.10401
		(5.09054)	(15.2895)	(9.86164)	(13.6454)
2	8393871.	1.624328	23.78106	14.13892	60.45570
		(12.1490)	(13.8800)	(10.9318)	(15.8398)
3	8662664.	3.150695	22.46841	17.24580	57.13509
		(22.3615)	(12.4000)	(9.59543)	(17.5431)
Cholesky Ordering: IND CGT WHT SDY					
Standard Errors: Monte Carlo (100 repetitions)					

Source: Author's computation using Eviews 12 (2024)

The variance decomposition in line with equation 1.2 with IND as the outcome variable was also interpreted in this study. It is observed in the result in Table 1.5 that in period one, IND is strongly endogenous as it accounted for 100% of the innovation in itself in period one. The movement from periods 1 to 2 and 3 witnessed minimal contributions from GCT (3.58% in period 2 and 7.36% in period 3), with 1.46% and 4.09% in period 3 by WHT and SDY, respectively. However, IND remained strongly endogenous both in the short run and long run as it accounted for 100%, 95.75%, and 87.07% of the innovations on itself in periods 1, 2, and 3, respectively.

CONCLUSION AND RECOMMENDATIONS

Drawing from the results in Table 1.4, where the overall result in line with equation 1.2 is statistically

insignificant (given that the p-value 0.2994 > 0.05), this study concluded that taxation as a fiscal measure has not impacted significantly on infrastructural development, although a positive relationship exists between the outcome and explanatory variables for the period under review in Nigeria. In other words, taxation as a fiscal policy tool has not addressed the infrastructural expectation gap in Nigeria for the period under investigation, which calls for the following recommendations;

1. There is a need for adequate utilization of WHT tax by the tax authority in Nigeria to enhance tax remittance accruing from income payment on dividends, interest, wages, and royalties to optimize infrastructural development in the country.
2. Policymakers need to optimize policy measures skewed towards tax revenue from the sale of assets rather than the undue reliance on PIT, PPT, and CIT, which have not addressed the infrastructural expectation gap in Nigeria.
3. There is an urgent need for the Nigerian government to revamp the postal service, which will enhance remittance in the emerging e-delivery market and the country's infrastructural development.

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