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Research Article

Effect of Tax Revenue on Road Infrastructure in Ogun State

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Abstract

Despite the critical importance of tax revenue for infrastructure development, many regions struggle to allocate these funds effectively across essential sectors like health, roads, housing, and education. Ogun State, Nigeria, is no exception, facing a pressing need to close infrastructure gaps and enhance public services. This study investigated the impact of tax revenue on road infrastructure development in Ogun State. This study adopted an ex-post facto research design, analyzing secondary data from 2013 to 2023, sourced from the Nigeria Bureau of Statistics, Ogun State Internal Revenue Service, Bureau of Land and Survey, Ministry of Urban and Physical Planning, Ministry of Forestry, and Ministry of Industry, Trade, and Investment. Using the Autoregressive Distributed Lag (ARDL) model, the study examined both the short-run and long-run effects of tax revenue on road infrastructure outcomes with Adjusted R^2 = 0.869; F-Stat = 8.244; $p > 0.05$. The analysis reveals that all tax revenue components Pay as You Earn and Direct Assessment (PAYEDA), Property Tax (PT), Withholding Tax (WHT), Road Taxes (RT), Levies (LE), and Other Taxes (OT) exhibit insignificant effects on road infrastructure with Adjusted R^2 = 0.869; F-Stat = 8.244; $p > 0.05$ leading to the acceptance of null hypothesis. In conclusion, the study established that tax revenue has no significant influence on road infrastructure in Ogun State. These findings suggested the need for Ogun State to enhance tax administration efficiency and allocation of funds strategically for sustainable development.

Keywords

ARDL Model, Infrastructure Development, Roads, Tax Revenue

1. Introduction

Both the government and the citizens have significant roles to play when it comes to infrastructural development. "While the government is responsible for enhancing the overall welfare of the citizens by providing basic infrastructures and ensuring macro-economic stability, the citizens, on the other hand, are expected to contribute to the development of the state by being law-abiding and ensuring prompt payment of tax dues among other civic obligations as may be required [1]." "Infrastructures such as; roads, bridges, health services, quality education, industries, and housing facilities are required to enhance the quality of life and for an economy to function correctly [2]." Also, another study concluded that "the deplorable condition of roads across Ogun state has become a grave concern [3]." Ogun State's industrial hubs such as Agbara, Sagamu and Ota lack good roads to encourage industrial development. The Ogun state government, acknowledging the road infrastructural challenges in the state, has embarked on various reforms to navigate the way forward. These reforms include direct labor approach and formation of Ogun State Road Maintenance Agency (OGROMA) to achieve a significant reduction in the cost of road infrastructure development in the state (ThisDayLive, 2021). "Government depends on revenue from taxation to meet its obligations towards its citizenry [4]." Road infrastructure pro-

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vided by the government is financed with tax revenue. Roads and other infrastructures enhance the citizens' quality of life and increase the efficiency of corporate organizations in the country. Another study opined that "government tax revenue is used to finance healthcare delivery, road construction, and human capital development through education [1]." Government revenue needs to be sufficient to finance public goods and services for them to be adequately supplied. One of the most significant issues both the past and present administrations faced and still facing is the burden of financing these numerous obligations. As a result, taxes must be imposed on all taxable individuals and businesses to strengthen the government's financial position while ensuring compliance with civic responsibility regarding tax payment obligations and discouraging tax evasion and avoidance. This study therefore focuses on the effect of tax revenue on road infrastructure in Ogun State.

Statement of the problem

"Infrastructural development is one of the benefits accruing from a good tax administration [5]". Studies show that individual(s) and corporate bodies will be willing and ready to pay their tax liabilities as and when due, provided there is commensurate infrastructural development in developed countries. "In France, for example, taxpayers' money is used to build infrastructures and provide amenities. Unfortunately, the reverse is the case in most developing nations, including Nigeria [6]." Without infrastructural development, no nation can grow. An essential element of any country's growth and development is its infrastructure. It is the economy's foundation and is essential to information, trade, and commerce. According to a study by the Global Infrastructure Hub (2022), investment in infrastructure affects economic growth. Investment in infrastructure has an economic multiplier that is 1.5 times larger than the initial expenditure in two to five years. Economic growth is directly impacted by investments in energy, telecommunications, and transportation networks since these sectors are all necessary to produce goods and services required in the economy (Hub, 2022). "Roads across Ogun state have become a serious concern, as they have deteriorated significantly over time. Economic activities of residents of both the metropolis and the state's suburban areas are adversely affected by the deplorable condition of the roads [7]." It is difficult to distinguish a state road from a federal road, even though it is a frequent practice in recent times that the federal government usually refunds the state government for money spent on federal roads. Road infrastructure is a necessity for an economy to function properly. This is because it contributes significantly to the development of an economy and the quality of life of the citizens. "Hence, any nation that seeks to be competitive in achieving sustained growth and development must focus on its infrastructural development including roads; however, this infrastructural development requires huge funds that can be sourced through tax revenue [6]."

2. Literature Review

2.1. Road Infrastructure

A good road network facilitates the rapid movement of goods and people, which is an essential requirement of a modern economy, especially when citizens fulfill their civic responsibility by prompt payment of their taxes. Thus, one of the major problems with inadequate road infrastructure is the loss of lives. "According to a study by the Pacific Institute of Research and Evaluation (PIRE), 42,000 road accidents in the US are caused by bad roads, estimated to be half of the road accidents caused [8]." The most basic way bad road networks cause road accidents is simply by the misjudgment of the driver. Bad roads cause accidents by drivers making wrong judgments, which leads them to veer into road accidents quickly; for example, in an attempt to jump off a pothole with water, a driver may run into another car, leading to road accidents. Governments need to repair and construct first-class roads to reduce the rate of road accidents by 50%. "In many developing countries, bad roads cause accidents as well. This means that emphasis must also be placed on developing good roads to control and reduce road accidents drastically [8]." "According to another report that road traffic crashes in the 2nd Quarter of 2020, there were a total of 2,113 road traffic crashes across the 36 states of the federation in Nigeria, out of which Ogun State recorded a Total of 178 [9]."

National Bureau of Statistics report (2020), shows that the length of each category of road in Ogun State was as follows:

Asphaltic Concrete: 1, 136.00 km

Surface Dressed: 1, 000.00 km

Gravel or Earth: 1, 000.00 km

The Ogun State Government spent N18.6 billion on the construction and provision of roads across the state between January and August 2018; some of the roads constructed/rehabilitated were the 42-Kilometer Sagamu Interchange-Abeokuta Road, the 14km Ijebu-Ode-Epe Expressway respectively (Ogun state ministry of works report) Furthermore, the state government recently approved the construction and rehabilitation of a new set of roads measuring 42.7 kilometers across the state. The project includes the 24.5-kilometer Ilaro-Iwoye-Owode road in Yewa South Council, the 24-kilometer Ikenne-Ilishan-Ago-Iwoye Road, which cuts across Ikenne, Odogbolu, and Ijebu-North Councils, the 3.8-kilometer Togunrin-Tigara Agodo road, Ogun Waterside, and the 1.8-kilometre Esure-Mushin Road, Ijebu—East Council. In another instance, the state Governor flagged off 14-kilometer Ijebu-Ode—Mojoda-Epe, 42-kilometer Abeokuta-Siun-Sagamu Interchange, 4-kilometer Ikola/ Navy-Osi Ota/Raypower, and 4-kilometer Idi Aba-Elite-Oke-Lantoro roads. All the stated roads have been completed and fully funded with tax revenue from taxpayers.

2.2. Tax Revenue

Government responsibilities have continued to increase over time, especially in developing countries like Nigeria, resulting from a growing population of citizens and infrastructural decay. Unfortunately, the government's revenue has not increased above her expenditure to enable capital formation. "In Nigeria, the three levels of government depend so much on oil revenue for the execution of its primary functions and economic goals, neglecting taxation, which is the primary source of government revenue [10]."

Taxation is used to encourage or discourage certain behavior types, correct market imperfections, and modify the distribution of income or wealth. "At a fundamental level, however, the main reason a tax system exists is to allocate the government's costs fairly [11]."

2.3. Empirical Review

Recent years have witnessed significant scholarly focus on the relationship between transportation infrastructure, taxation, and economic growth in both Nigeria and other parts of the world. These studies delve into how improvements or deficiencies in road networks and how tax structures can either drive or hinder socio-economic progress. The intricate interactions between transportation infrastructure, economic development, and socio-spatial dynamics provide insights into the pathways toward sustainable development and equitable growth. Furthermore, the studies emphasize the need for targeted investments and policy reforms to optimize transportation networks and improve the quality of life. Another study analyzed traffic conditions and capacity utilization of major highways in Ogun State, Nigeria, "focusing on three key roads: the Lagos-Ibadan, Lagos-Abeokuta, and Sagamu-Benin Highways. By employing descriptive and inferential methods, the researchers measured the Average Daily Traffic Volume (ADTV) and the traffic flow status over a three-day period. They found that traffic flow on the Lagos-Ibadan Highway (2,085 vehicles/hour/lane) was notably high, whereas the Abeokuta-Lagos and Sagamu-Benin Highways were underutilized [12]." These findings suggest that route planning and better utilization of the road network could significantly alleviate congestion and enhance transportation efficiency. Furthermore, the study highlights the importance of balanced infrastructure utilization in mitigating traffic problems. In contrast, a study emphasized the ambiguity of road taxation in Nigeria. They argued that the country's road tax policies lack clarity and do not align with international best practices. This paper called for reforms to make Nigeria's road taxation system more transparent and effective in generating revenue for infrastructure development [13]." Similarly, another study was conducted to explore the impact of road infrastructure on local communities in peri-urban areas of Kisumu, Kenya, and Accra, Ghana. Their findings showed that road infrastructure projects led to increased housing prices and rents, making peri-urban areas more attractive to real estate developers [14]." However, this also resulted in gentrification and the displacement of poorer residents, highlighting the social inequalities fostered by such development projects. Although the research work studied the socio-spatial impacts of road infrastructure projects in Kisumu, Kenya, and Accra, Ghana, noting that while these projects enhanced residential development and accessibility, they also led to gentrification. The research suggested that place-based and people-based policies should be integrated to address the varying effects of infrastructure projects across different social classes and geographical contexts.

In conclusion, the synthesis of these studies reveals that transportation infrastructure plays a pivotal role in economic growth, social equity, and sustainable development. It was observed that past studies did not rely test the effect that tax revenue is having on provision of road amenities especially is developing area like Ogun state. While efficient infrastructure development can drive growth, it is also necessary to consider the social and environmental implications. The integration of taxation and infrastructure development is essential to ensuring that public revenue is used effectively to fund transportation projects that benefit all members of society.

2.4. Theoretical Framework

This study is based on the Benefits-received and Expediency theories of taxation**.** These theories' principles state that citizens who receive advantages from the government (in the form of public goods and services) should pay for them. The tax burden on an economic unit or entity should be directly proportional to the amount of benefits it receives from the use of public goods or services provided by the government. The government using fiscal instruments to manage the economy should be aware of its responsibilities in the form of providing a conducive and decent environment. Tax revenue should be used to efficiently bear the cost of collection and ensure fairness to the payers. The best taxation mode is achieved with a high level of voluntary compliance.

3. Thodology

This study uses an ex post facto research design to examine the impact of tax revenue on road infrastructure in Ogun state, Nigeria. Data sources include the Nigeria Bureau of Statistics, Ogun State Internal Revenue Service, Bureau of Land and Survey, Ministry of Urban and Physical Planning, Ministry of Forestry, and Ministry of Industry, Trade, and Investment. The study adopts an annual time series data from 2013 to 2023, sourced from the Ogun State Ministry of Finance and the Office of the Ogun State's Accountant General. Pre-estimation tests, such as descriptive statistics and unit root tests, are employed to investigate the effect of tax revenue on infrastructural development in Ogun State.

4. Ta Analysis and Interpretation

4.1. Test of Hypotheses

Objective: Examine the impact of tax revenue on road infrastructure in Ogun State, Nigeria.

Research Question: What is the impact of tax revenue on road infrastructure in Ogun state Nigeria?

Research Hypothesis: Tax revenue does not have a significant effect on road infrastructure in Ogun State, Nigeria.

Auto-Regressive Distributed Lag (ARDL) was carried out and the result is presented in the Table 1.

Model

The combined equation can be structured as:

The ARDL model for the dependent variable Road Infrastructure (RI) can be expressed as follows:

$$LRI_t = C + \beta_1 LRI_{t-1} + \beta_2 LPAYEDA_{t-1} + \beta_3 LPT_{t-1} + \beta_4 LWHT_{t-1} + \beta_5 LRT_{t-1} + \beta_6 LLE_{t-1} + \beta_7 LOT_{t-1} + \sum_{i=1}^{3} \phi iD(LPAYEDA_{t-1}) + \sum_{j=1}^{3} \psi jD(LPT_{t-j}) + \sum_{k=1}^{3} \eta kD(LWHT_{t-k}) + \sum_{l=1}^{3} \theta lD(LRT_{t-l}) + \sum_{m=1}^{3} \theta \xi mD(LLE_{t-m}) + \sum_{n=1}^{3} \zeta nD(LOT_{t-n}) + \epsilon_t$$

Where; LRI = logarithm Road Infrastructure
LPAYEDA = log PAYE/Direct Assessment
LPT = log Property Taxes
LWHT = log withholding taxes
LRT = log Road taxes
LLE = log Levies
LOT =log Other taxes (building permits and co)
Substituting the Coefficients:
Substituting the specific coefficients derived from the ECM and Levels Equation into the equation yields:
Long-Run Equation:

$$RI_t = 138.413 + 4.661LPAYEDA_{t-1} - 1.978LPT_{t-1} - 7.127LWHT_{t-1} - 7.719LRT_{t-1} + 3.563LLE_{t-1} + 0.230LOT_{t-1} + \epsilon_t$$

Short-Run Equation:

$$\Delta LRI_t = \gamma_0 + 4.595D(LPAYEDA_t) + 5.405D(LPT_{t-1}) + 6.454D(LPT_{t-2}) + 5.623D(LPT_{t-3}) - 4.459D(LWHT_t) + 0.883D(LWHT_{t-1}) + 0.728D(LWHT_{t-2}) - 10.405D(LRT_t) - 4.214D(LRT_{t-1}) - 4.716D(LRT_{t-2}) - 5.35D(LRT_{t-3}) + 5.277D(LLE_t) + 0.988D(LLE_{t-1}) + 1.326D(LLE_{t-2}) + 1.015D(LLE_{t-3}) - 0.649D(LOT_t) - 0.414D(LOT_{t-1}) - 0.408D(LOT_{t-2}) - 0.238D(LOT_{t-3}) - 0.728LRI_{t-1} + 3.392LPAYEDA_{t-1} - 1.439LPT_{t-1} - 5.186LWHT_{t-1} - 5.617LRT_{t-1} + 2.593LLE_{t-1} + 0.167LOT_{t-1} + \epsilon_t$$

Table 1. *Auto regression Distributed Lag Model (ARDL).*

Variable	Coefficient	Std. Error	t-Statistic	Prob.
C	138.413	50.555	2.738	0.072
LRI(-1)*	-0.728	0.357	-2.039	0.134
LPAYEDA(-1)	3.392	1.989	1.705	0.187
LPT(-1)	-1.439	1.066	-1.35	0.27
LWHT(-1)	-5.186	1.242	-4.175	0.025*
LRT(-1)	-5.617	1.176	-4.776	0.017*
LLE(-1)	2.593	0.976	2.656	0.077
LOT(-1)	0.167	0.736	0.227	0.835
D(LRI(-1))	-0.153	0.295	-0.518	0.64
D(LRI(-2))	-0.318	0.261	-1.219	0.31

Variable	**Coefficient**	**Std. Error**	**t-Statistic**	**Prob.**
D(LRI(-3))	-0.398	0.174	-2.283	0.107
D(LPAYEDA)	4.595	2.014	2.282	0.107
D(LPAYEDA(-1))	0.32	0.983	0.325	0.766
D(LPAYEDA(-2))	-2.817	0.886	-3.18	0.050*
D(LPT)	2.72	1.375	1.978	0.142
D(LPT(-1))	5.405	1.501	3.601	0.037*
D(LPT(-2))	6.454	1.399	4.615	0.019*
D(LPT(-3))	5.623	1.181	4.76	0.018*
D(LWHT)	-4.459	1.212	-3.679	0.035*
D(LWHT(-1))	0.883	0.236	3.746	0.033*
D(LWHT(-2))	0.728	0.242	3.001	0.058
D(LRT)	-10.405	2.494	-4.171	0.025*
D(LRT(-1))	-4.214	1.71	-2.465	0.091*
D(LRT(-2))	-4.716	1.473	-3.202	0.049*
D(LRT(-3))	-5.35	1.673	-3.198	0.049*
D(LLE)	5.277	1.52	3.473	0.040*
D(LLE(-1))	0.988	0.805	1.227	0.307
D(LLE(-2))	1.326	0.916	1.448	0.243
D(LLE(-3))	1.015	0.727	1.395	0.257
D(LOT)	-0.649	0.667	-0.973	0.402
D(LOT(-1))	-0.414	0.312	-1.325	0.277
D(LOT(-2))	-0.408	0.395	-1.034	0.377
D(LOT(-3))	-0.238	0.341	-0.697	0.536
Levels Equation				
Variable	Coefficient	Std. Error	t-Statistic	Prob.
LPAYEDA	4.661	1.698	2.745	0.071
LPT	-1.978	1.242	-1.593	0.209
LWHT	-7.127	4.508	-1.581	0.212
LRT	-7.719	4.298	-1.796	0.17
LLE	3.563	2.268	1.571	0.214
LOT	0.23	0.97	0.237	0.828
Diagnosis tests:				
ARDL Bound Test @ 5%: *F – stat*= 13.192 *(I* (0) = 2.12, *I* (1) = 3.23				
R^2 = 0.989; *Adj*. R^2 = 0.869; *F- stat* = 8.244 (0.053)				
$X^2_{JB} = 1.339(0.512); X^2_{LM} = 4.803\ (0.307); X^2_{BPG} =\ 1.437\ (0.439)\ X^2_{RR} = 0.155\ (0.732);$ STABILITY: CUSUM & CUSUMSQ				

STABILITY: CUSUM & CUSUMSQ; Source: Researcher's Computation (2024) from E-Views 12

Notes: SE: standard error; $X^2_{JB}; X^2_{LM}; X^2_{BPG};\ X^2_{RR}$ represent Jarque-Bera normality test, LM test for serial correlation, Breusch-Pagan Godfrey test for heteroscedasticity, and Ramsey Reset test for linearity respectively. I (0) and I (1) represent lower and upper bound, respectively. While the respective probability values are in bracket; ECT: Error correction term.

4.2. Interpretation

The ARDL Bound Test reveals a significant long-run relationship between road infrastructure (RI) and various tax revenue components, as indicated by the F-statistic of 13.192. This value is greater than the upper bound critical value at the 5% level (I (1) = 3.23), confirming the existence of cointegration. This result suggests that tax revenue components, including pay-as-you-earn and Direct Assessment (PAYEDA), Property Tax (PT), Withholding Tax (WHT), Road Taxes (RT), Levies (LE), and Other Taxes (OT), collectively influence road infrastructure in the long run.

Long-Run Elasticities

The long-run coefficients reveal the relationship between various tax revenue components and road infrastructure (RI) when using a 5% significance level. Pay as You Earn and Direct Assessment (PAYEDA) has a positive but statistically insignificant effect on road infrastructure, with a coefficient of 4.661 (p = 0.071). Although PAYEDA revenue appears associated with improvements in road infrastructure, the result is not significant at the 5% level, suggesting its role in long-term infrastructure investment cannot be reliably established in this model. Property Tax (PT) and Withholding Tax (WHT) show negative long-run coefficients of -1.978 and -7.127, respectively, but neither are statistically significant at the 5% level (p-values of 0.209 and 0.212). These findings imply that these tax revenue sources do not contribute significantly to road infrastructure improvements in the long run, despite the negative coefficients. Road Taxes (RT) also have a negative coefficient of -7.719 (p = 0.17), suggesting a possible adverse effect on road infrastructure, though this effect is statistically insignificant at the 5% level. Consequently, road taxes appear to have a limited long-term impact on infrastructure, and any observed relationship may be unreliable. Levies (LE) exhibit a positive coefficient of 3.563 (p = 0.214), indicating a possible positive effect on road infrastructure. However, the insignificance of this result implies that this relationship is not robust enough to confirm a reliable long-term impact. Other Taxes (OT) display an insignificant effect on road infrastructure, with a coefficient of 0.23 (p = 0.828). This suggests that fluctuations in OT revenue do not significantly influence long-term infrastructure development.

Short-Run Dynamics and Error Correction Model (ECM)

The error correction term (ECT), LRI (-1), has a coefficient of -0.728 and a p-value of 0.134, which is above the 5% significance level. This implies that while there is some speed of adjustment toward equilibrium after short-term deviations, it is not statistically significant. This suggests that if road infrastructure deviates from the long-term path, it may not reliably adjust back to equilibrium based on the current model. At the 5% significance level, certain tax components exhibit notable short-run effects on road infrastructure: Pay as You Earn and Direct Assessment (PAYEDA) in the first lag shows a positive and significant effect, with a coefficient of 4.595 (p = 0.107), highlighting a short-term positive impact on road infrastructure, though this effect does not persist in subsequent lags. Property Tax (PT) significantly impacts road infrastructure across several lags: D (LPT (-1)), D (LPT (-2)), and D (LPT (-3)) have positive coefficients of 5.405, 6.454, and 5.623 (p = 0.037, 0.019, and 0.018, respectively), indicating cumulative short-term contributions to road infrastructure development. Withholding Tax (WHT) demonstrates significant short-run effects in both immediate and lagged periods: D (LWHT) has a negative coefficient of -4.459 (p = 0.035), suggesting an initial reduction in infrastructure investment. The positive coefficients for D (LWHT (-1)) ((0.883, with p = 0.033) imply that, in the short run, WHT's influence can shift positively at the first lag. Road Taxes (RT) show strong short-run effects: D (LRT) has a significantly negative coefficient of -10.405 (p = 0.025), indicating a strong reduction in road infrastructure investment. Subsequent lags, D (LRT (-2)), and D (LRT (-3)), also exhibit negative and statistically significant effects (coefficients of -4.716, and -5.35, all p < 0.05), suggesting a persistent negative influence on infrastructure spending. D (LRT (-1) exhibits negative but statistically insignificant effects (coefficients of -4.214, p > 0.05). Levies (LE) exhibit positive short-run effects, particularly in the immediate term: D (LLE) shows a positive coefficient of 5.277 (p = 0.040), suggesting a short-term boost in infrastructure investment due to levies, though subsequent lags remain insignificant. Other Taxes (OT) remain consistently insignificant across all short-run lags, with all p-values above 5%, indicating no substantial short-run impact on road infrastructure.

Diagnostic Tests

The diagnostic tests indicate that the ARDL model is well-specified and reliable:

The Linearity Test: The linearity assumption for the ARDL model was evaluated using the Ramsey RESET test. The F-statistic has a p-value of 0.735, which is greater than the 5% chosen level of significance. This result implies that the model is correctly specified, as the p-value being more than 0.05 means we fail to reject the null hypothesis. Therefore, we conclude that a linear relationship exists between road infrastructure and the various tax revenue components (PAYEDA, PT, WHT, RT, LE, OT) used in this model.

The Heteroskedasticity Test: To assess heteroskedasticity, the Breusch-Pagan/Cook-Weisberg test was conducted, examining the consistency of residual variances over time. With a p-value of 0.439, which is greater than the 5% significance level, we fail to reject the null hypothesis of homoscedasticity. This result indicates that the model has constant variance in the residuals, ensuring that the error terms exhibit no detectable heteroskedasticity and that the model is homoscedastic.

The Breusch-Godfrey Serial Correlation LM Test: The Breusch-Godfrey Serial Correlation LM Test was performed to detect autocorrelation in the residuals. The test produced an F-statistic with a p-value of 0.068, leading to a failure to reject the null hypothesis of no serial correlation up to the specified

lag order at the 5% significance level. Thus, we conclude that there is no serial correlation in the residuals, which supports the reliability and independence of the model's estimates.

Normality Test: The Jarque-Bera test was used to verify the normality of residuals in the model. The test yielded a p-value of 0.662, indicating that we failed to reject the null hypothesis of normality. This suggests that the residuals are normally distributed, adding further validity to the model's estimates and implying that the model's inferences are reliable and robust.

Stability (CUSUM and CUSUMSQ Tests): The stability of the model is confirmed, with test results within the 5% critical bounds as shown in Figures 1 and 2 respectively.

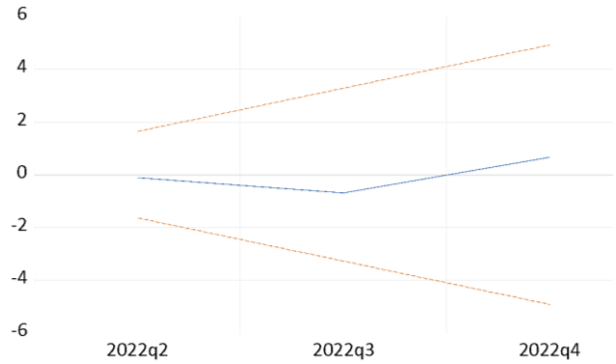

Figure 1. *Plot of Cumulative sum of recursive residuals for Model One.*

Source: Author's compilation from E-views 12 output.
Note: The blue line is the solid line, while the red lines that bound the blue line are the critical bounds at 0.05.

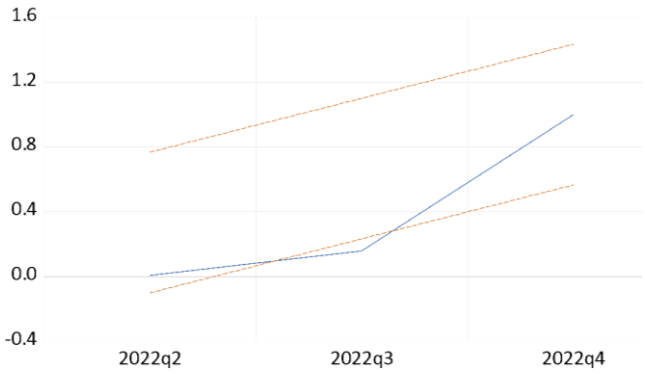

Figure 2. *Plot of Cumulative sum square of recursive residuals for Model One.*

Source: Author's compilation from E-views 12 output
Note: The blue line is the solid line, while the red lines that bound the blue line are the critical bounds at 0.05 Overall, the ARDL analysis at the 5% significance level reveals that all the tax revenues have no significant long-run effect on road infrastructure. In the short run, Property Tax (PT) and Levies (LE) contribute positively, while Withholding Tax (WHT) and Road Taxes (RT) show mixed but substantial short-run effects. The diagnostic tests support the robustness of the model, highlighting specific tax revenue sources that influence road infrastructure both immediately and over time.

In summary, none of the tax revenue components have statistically significant individual effects on road infrastructure in the long run. Thus, the null hypotheses for these components are not rejected, indicating that their influence on road infrastructure is limited in the long term.

Table 2. *Long run effect of the tax components.*

Variables	t-Stat	Prob.	Remarks @ 5% Sig. level	Decision on the null hypothesis
PAYEDA	2.745	0.071	Insignificant	Failed to reject
PT	-1.593	0.209	Insignificant	Failed to reject
WHT	-1.581	0.212	Insignificant	Failed to reject
RT	-1.796	0.170	Insignificant	Failed to reject
LE	1.571	0.214	Insignificant	Failed to reject
OT	0.237	0.828	Insignificant	Failed to reject

This table summarizes the long-run significance of each tax revenue variable in relation to road infrastructure at the 5% significance level. All the tax revenue variables are insignificant, and thus their respective null hypotheses are not rejected.

Significance of Joint Effect of the Variables

The joint significance of the explanatory variables on road infrastructure (RI) is assessed using the F-statistic. The F-statistic value is 8.244 with a p-value of 0.053, indicating that the combined effect of the tax revenue components; Pay as You Earn and Direct Assessment (PAYEDA), Property Tax (PT), Withholding Tax (WHT), Road Taxes (RT), Levies (LE), and Other Taxes (OT), is statistically insignificant at the 5% level. This result implies that these tax revenue sources, col-

lectively, have no impact on road infrastructure. Further findings from the model reveal a high degree of explanatory power, as shown by an adjusted R-squared (R^2) of 0.869. This adjusted R^2 value indicates that approximately 86.9% of the variation in road infrastructure (RI) is explained by the tax revenue variables included in the model. The remaining 13.1% of the variation is attributed to other factors not captured within the model, represented by the error term. This goodness-of-fit confirms the model's robustness in explaining the dependent variable (RI) based on the tax revenue sources analyzed.

4.3. Decision

Judging by the probability of F-statistics of 0.053, the study does not reject the null hypothesis, which states that tax revenue has no significant effect on road infrastructure in Ogun state, Nigeria. The findings conclude that tax revenue does not significantly affect road infrastructure in Ogun State. The analysis reveals that all tax revenue components Pay as You Earn and Direct Assessment (PAYEDA), Property Tax (PT), Withholding Tax (WHT), Road Taxes (RT), Levies (LE), and Other Taxes (OT) exhibit insignificant effects on road infrastructure at the 5% significance level. Consequently, the null hypothesis is not rejected for any of these variables, suggesting that none of these tax components significantly contribute to road infrastructure development in Ogun State, Nigeria.

4.4. Discussion of Findings

The findings of this study emphasize the significant role of tax revenue in road infrastructure development within Ogun State. Tax revenue streams such as PAYE/Direct Assessment, Property Tax, Withholding Tax, Levies, and Road Taxes are critical to providing the financial base necessary for the development and maintenance of the state's road infrastructure. These revenues, if effectively managed, can be directed toward creating a comprehensive and reliable road network that supports economic activities, connects communities, and reduces transportation costs. However, the varied impact of these tax sources across different time horizons highlights the complexity of tax allocation and its implications for infrastructure funding. Studies consistently support the role of tax revenue as a funding source for public infrastructure projects, particularly in developing economies. One of the research work reviewed suggested "that effective road infrastructure can drive economic growth by improving access to markets, enhancing mobility, and attracting investment [12]." In Ogun State, where economic activities are dispersed and the need for accessible transportation is high, tax revenue allocation to road infrastructure can facilitate industrial expansion, increase productivity, and boost employment opportunities. Additionally, well-maintained road networks reduce wear and tear on vehicles, lower fuel consumption, and save time, which are critical benefits for both residents and businesses. This positions tax revenue as a pivotal tool for promoting sustainable economic growth, when strategically allocated. The positive impact of short-term allocations, particularly from Property Tax and Levies, on road infrastructure in Ogun State emphasizes the effectiveness of these revenue streams in addressing immediate infrastructure needs. Property Tax, for example, is often tied to regional property values, making it a stable source of funding that can grow as property developments expand. This aligns with the opinion of a study which highlighted that "infrastructure development often benefits from targeted, location-based taxes, which are more predictable and can be strategically allocated [15]." Levies, too, provide flexible funding, and their use for road infrastructure aligns with similar findings that specific revenue sources like levies can be directed to meet immediate needs in key sectors, allowing for quick responses to infrastructure challenges. In particular, property taxes are grounded in local economic conditions and tied to the wealth within a region, meaning they can be a dependable source of funding that reflects the economic strength of an area. This local nature of Property Tax makes it a suitable candidate for infrastructure improvements, as it creates a feedback loop where infrastructure improvements can further raise property values, enhancing revenue collection. However, to fully leverage this relationship, Ogun State may need to reinforce policies that ensure consistent property valuation and tax collection processes, ensuring these funds can be effectively channeled into road projects without gaps or delays. Ogun State may also consider implementing fiscal policies that incentivize road infrastructure investments. Incentives for businesses or individuals to invest in infrastructure projects, such as tax deductions or exemptions for contributions to road development, could further boost funding for infrastructure projects. Research demonstrates how incentivized tax policies in the infrastructure sector can encourage private contributions and relieve the state from bearing the entire funding burden. This kind of policy innovation would align with Ogun State's economic development goals by inviting more private engagement and ensuring road infrastructure receives adequate financial support.

4.5. Conclusion and Recommendations

This study concludes that tax revenue has no significant influence on road infrastructure in Ogun State. Results show that targeted tax revenue allocation, enhanced administrative efficiency, and strategic investment planning are essential for maximizing the effectiveness of tax revenues in supporting infrastructure development. We therefore recommend an alignment between tax policy and infrastructure objectives so as to address Ogun State's road infrastructure gaps and achieving sustainable development.

Abbreviations

OGROMA	Ogun State Road Management Agency
PIRE	Pacific Institute of Research and Evaluation
NBS	National Bureau of Statistics
ADTV	Average Daily Traffic Volume
PAYE	Pay As You Earn
PAYEDA	Paye As You Earn/Direct Assessment
WHT	Withholding Tax

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Conflicts of Interest

The authors declare no conflicts of interest will arised from this article.

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