Modelling the Effects of Tax Administration Efficiency and Governance on Income Inequality in Nigeria

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Abstract
This study examines the effects of tax administration efficiency and governance on income inequality in Nigeria, with particular emphasis on the moderating role of governance. Annual time-series data covering 1990–2025 were analyzed using the Vector Error Correction Model (VECM) framework to investigate short-run dynamics and long-run relationships among income inequality, tax administration efficiency, governance, their interaction, government social expenditure, and interest rate. Tax administration efficiency is represented by a composite index, while the analysis incorporated an interaction term to assess whether governance conditions its relationship with income inequality. The results indicate that governance had a negative and statistically significant short-run coefficient, while the interaction between tax administration efficiency and governance is also negative and statistically significant. Tax administration efficiency exhibited a positive short-run coefficient, although its statistical significance is sensitive to the chosen significance threshold. Government social expenditure and interest rate are not statistically significant in the short-run equation at the 5% level. The normalized long-run relationship presents different coefficient signs for governance, the interaction term, and government social expenditure, suggesting that their associations with income inequality may vary over time. Safe to say, these findings indicate that the relationship between tax administration efficiency, governance, and income inequality is conditional rather than uniform. The study recommends strengthening tax administration alongside accountable governance, progressive taxation, and equitable public spending to improve the potential distributional outcomes of fiscal policy.

Keywords: *Tax administration efficiency, governance, income inequality, VECM, Nigeria.*

1. Introduction

Domestic revenue mobilization is fundamental to government capacity to finance public services and promote inclusive economic development. Consequently, understanding the relationship between tax administration efficiency and income inequality requires attention to both fiscal

performance and institutional quality. Tax administration efficiency reflects the capacity of tax authorities to identify taxpayers, assess tax liabilities, facilitate compliance, enforce tax obligations, and minimize revenue leakages. A multidimensional assessment is therefore necessary to distinguish the broader efficiency of tax administration from the performance of individual tax categories or aggregate revenue collections. The relationship between tax administration efficiency and income inequality is potentially complex. Chong and Gradstein (2007) show that institutional quality and inequality can be mutually related, while Lustig (2018) demonstrates that the distributional effect of fiscal policy depends on the combined incidence of taxes, transfers, and public expenditure.

Nigeria provides a relevant context for investigating these relationships. Tax capacity depends on administrative capability, the breadth of the tax base, and compliance, while distributive outcomes also reflect how public resources are allocated and utilized (Bird & Zolt, 2005; Besley & Persson, 2014). Governance is important because the distributional benefits of revenue mobilization depend on public-sector integrity, implementation capacity, and accountability. Weak institutions can reduce the effectiveness of public spending and weaken the link between taxation and public services (North, 1990; Tanzi & Davoodi, 1997; Kaufmann et al., 2010).

An important empirical question is whether governance merely influences income inequality independently or also moderates the relationship between tax administration efficiency and income distribution. Nevertheless, the extent to which governance conditions the relationship between tax administration efficiency and income inequality in Nigeria requires specific empirical investigation. Existing Nigerian evidence also suggests that the relationship between taxation and income distribution is not uniform. Studies focused on individual tax categories or aggregate revenue may not capture the multidimensional nature of tax administration efficiency or the moderating role of governance. International research similarly emphasizes that tax progressivity and spending incidence jointly shape redistribution (OECD, 2015; IMF, 2015; Lustig, 2018).

This study addresses these gaps by examining the effects of tax administration efficiency and governance on income inequality in Nigeria. The specific objectives:

1. Examine the effect of tax administration efficiency on income inequality in Nigeria.
2. Determine the effect of governance on income inequality in Nigeria.
3. Examine the moderating effect of governance on the relationship between tax administration efficiency and income inequality in Nigeria.
4. Assess the control effects of government social expenditure and interest on income inequality in Nigeria.

2. Related Literature

2.1 Theoretical Review

Fiscal Exchange Theory

Fiscal Exchange Theory builds on Wicksell (1896) and Lindahl (1919), who examined the relationship between taxation and the provision of public goods. The fiscal-exchange perspective links citizens' willingness to comply with taxes to the perceived quality and fairness of public services (Bird et al., 2008). The distributive consequences of taxation depend partly on how effectively public revenue is mobilized and translated into public services. Evidence on fiscal redistribution therefore suggests that taxes and spending should be assessed jointly rather than in isolation (Lustig, 2018; OECD, 2015). This theory underpins the relationship between tax administration efficiency, government social expenditure, and income inequality in this study. It

suggests that efficient tax collection can promote equity when revenue is translated into accessible and fairly distributed public services, while weak redistribution may limit its inequality-reducing potential.

Institutional Theory

Institutional Theory emphasizes the role of formal rules, administrative structures, and enforcement mechanisms in shaping economic behaviour and public-sector performance (North, 1990). Applied to taxation, effective tax administration requires institutions capable of enforcing tax laws consistently, limiting corruption, maintaining reliable taxpayer records, and ensuring predictable administrative procedures. Institutional capacity is also central to state capacity and revenue collection (Besley & Persson, 2014; Fjeldstad & Moore, 2008). This theory provides the foundation for incorporating governance into the model. It explains how governance quality may influence the effectiveness of tax administration and condition its distributional effects. This supports the inclusion of governance and the interaction between tax administration efficiency and governance in explaining income inequality.

Optimal Tax Theory

Optimal Tax Theory examines how governments can design and administer taxes to raise revenue while accounting for efficiency, equity, and behavioural responses. Mirrlees (1971) formalized the trade-off between redistribution and incentives, while subsequent work highlights that administrative constraints influence which tax systems can be implemented in practice (Slemrod & Yitzhaki, 2002). This Theory justifies examining the distributional consequences of tax administration efficiency rather than treating revenue mobilization as its sole objective. It suggests that the effectiveness of tax administration in reducing inequality depends on tax design, enforcement capacity, behavioural responses, and the balance between revenue generation and equity. This provides the theoretical basis for investigating the effects of tax administration efficiency on income inequality.

2.2 Conceptual Clarifications

Tax Administration Efficiency: Tax administration refers to the institutional and operational processes through which tax authorities register taxpayers, assess liabilities, process returns and payments, monitor compliance, conduct audits, and enforce tax obligations. Administrative quality affects both the cost of compliance and the capacity to collect legally due revenue (Bird & Zolt, 2005; OECD, 2015).

Governance: Governance refers to the quality of institutions and the processes through which public authority is exercised, policies are implemented, and public resources are managed. Common governance frameworks assess dimensions such as government effectiveness, regulatory quality, rule of law, and control of corruption (Kaufmann et al., 2010).

In the context of tax administration, governance influences the consistency of enforcement, the credibility of public institutions, and the management of revenue after collection.

Income Inequality: Income inequality describes the extent to which income is unevenly distributed among individuals or households within an economy. The Gini coefficient is widely used to summarize inequality, although estimates can vary with data coverage and methodological choices (Solt, 2020).

The Relationship among Tax Administration Efficiency, Governance, and Income Inequality: Government social expenditure and interest rates are included as control variables because public expenditure may influence access to services and economic opportunities, while interest rates can affect borrowing costs, investment, employment, and income generation.

2.3 Empirical Review

Taxation, Tax Administration, and Income Inequality

Recent empirical studies have increasingly questioned the assumption that increased tax revenue necessarily improves income distribution. Ouedraogo et al. (2022), using instrumental-variable two-stage least squares and quantile regression across 45 Sub-Saharan African countries covering 1980–2018, found that taxation increased income inequality, with stronger effects in countries experiencing higher initial inequality. They also identified nonlinear effects of indirect taxation, suggesting that the distributional implications of taxation depend on tax composition and existing inequality conditions. Brown et al. (2023), examining 36 Sub-Saharan African countries using the Generalized Method of Moments (GMM), similarly reported that changes in the relative composition of direct and indirect taxes significantly influenced income inequality. Their findings indicate that the distributional effect of taxation depends on the structure of the tax system rather than revenue mobilization alone. Voto and Ngepah (2024), using dynamic common correlated effects and cross-sectional autoregressive distributed lag estimators for 30 Sub-Saharan African economies from 1980–2020, found that personal income tax increased income inequality across the full sample, although the effect was negative among least-developed countries. Their findings further showed that fiscal redistribution moderated the inequality-enhancing effect of personal income tax, highlighting the importance of redistributive mechanisms. In a related study, Mackenzie *et al*. (2023) assessed tax administration efficiency in 27 African countries using stochastic frontier and data envelopment analysis. They found substantial variations in tax administration efficiency and identified administrative autonomy, informal-sector size, non-tax revenue, and taxpayer segmentation as relevant efficiency determinants. Although their study did not examine inequality directly, it demonstrates that revenue administration performance is influenced by institutional and operational conditions. Collectively, these studies suggest that taxation and tax administration may produce different outcomes, and that improvements in administrative efficiency do not necessarily guarantee equitable income distribution.

Governance, Institutional Quality, and Income Inequality

Recent empirical evidence also reveals that the relationship between governance and income inequality is not uniform. Adegboye (2023), employing instrumental-variable estimation across 42 Sub-Saharan African countries over 1996–2014, investigated taxation, democracy, and inequality, emphasizing the role of democratic institutions in influencing the distributional effects of taxation. Dossou *et al*. (2025), using GMM estimation for 42 Sub-Saharan African countries covering 1996–2020, found that governance quality was associated with increased income inequality, while ICT improved income distribution and moderated the governance–inequality relationship. Their results suggest that governance improvements alone may not automatically produce equitable outcomes, particularly where institutional reforms are not accompanied by mechanisms that improve service delivery and inclusion. Onatunji (2025), examining the fiscal policy–income inequality nexus in Sub-Saharan Africa using the Cross-Sectional Autoregressive Distributed Lag (CS-ARDL) approach, found that government tax and some demographic and growth factors increased inequality, while education, government expenditure, and institutional quality mitigated it. The

study further emphasized the importance of institutional quality in enhancing the distributional effectiveness of fiscal policy. Similarly, a 2024 study on corruption and income inequality in Sub-Saharan Africa using a Panel Smooth Transition Regression approach found a nonlinear, U-shaped relationship between corruption and inequality, with corruption significantly increasing inequality beyond certain thresholds. These findings suggest that governance and institutional quality may influence income distribution through nonlinear and context-dependent channels, making country-specific analysis important.

Fiscal Redistribution, Government Expenditure, and Inequality

The distributional consequences of fiscal policy depend not only on tax collection but also on the composition, targeting, and effectiveness of public expenditure. Voto and Ngepah (2024) found that fiscal redistribution moderated the inequality-increasing effect of personal income tax in Sub-Saharan Africa, although the direction of redistribution effects differed across country groups. Their findings suggest that expenditure and redistribution mechanisms can alter the final distributional impact of taxation. Onatunji (2025) similarly found that government expenditure reduced income inequality in Sub-Saharan Africa in both the short and long run, reinforcing the importance of public expenditure as a redistributive mechanism. In a more recent comparative study, Alemu (2025) examined tax reform and redistribution in Ethiopia and Mozambique using structural-break analysis. The study found that the redistributive outcomes of tax reforms differed across countries and reform episodes, with some reforms contributing to redistribution while others produced contrasting effects. This suggests that the distributional consequences of tax administration and fiscal reforms are dependent on implementation context and policy design rather than reform adoption alone. These studies collectively indicate that government expenditure and redistribution can contribute to reducing income inequality, but their effects depend on expenditure effectiveness, policy design, institutional conditions, and the socioeconomic characteristics of beneficiaries. Consequently, the relationship between government social expenditure and income inequality cannot be presumed to be immediate or uniform across time.

The Moderating Role of Governance in Fiscal and Socioeconomic Outcomes

Increasing empirical attention has been directed toward interaction effects, particularly whether institutional quality changes the distributional consequences of fiscal and socioeconomic factors. Adegboye (2023) demonstrated the relevance of democracy to the taxation–inequality relationship, suggesting that institutional conditions may influence the redistributive effectiveness of taxation. Voto and Ngepah (2024) similarly established that fiscal redistribution modifies the relationship between personal income tax and inequality, although the effects varied across country classifications. Adeleye (2024), examining 46 Sub-Saharan African countries over 2010–2019 using panel and quantile-based estimation techniques, found that the interaction between institutional quality and human capital reduced income inequality, even where the individual effects of these variables were inequality-enhancing in some specifications. In a related study, Adeleye (2024) investigated whether institutional quality moderates the human capital–inequality relationship across Latin America and Sub-Saharan Africa and reported that the interaction between human capital and institutional quality significantly reduced inequality, particularly across upper inequality quantiles. Dossou et al. (2025) also found that ICT modified the governance–inequality relationship, indicating that institutional effects may depend on complementary mechanisms.

Furthermore, Kassouri et al. (2025), examining 20 Sub-Saharan African countries, found that the effect of financial development on income inequality varied according to institutional conditions, with stronger institutions supporting more equitable outcomes through the financial development–institutional quality interaction. Although these studies examine interactions involving taxation, redistribution, human capital, ICT, and financial development rather than tax administration efficiency specifically, they collectively establish that the distributional consequences of economic and fiscal mechanisms may depend on institutional quality. The reviewed literature therefore reveals that although recent studies have investigated taxation, governance, redistribution, and institutional interaction effects on income inequality, limited attention has been directed toward the specific moderating role of governance in the tax administration efficiency–income inequality relationship within Nigeria. The present study addresses this gap by incorporating tax administration efficiency, governance, and their interaction into a Nigerian time-series framework, while distinguishing between short-run dynamics and long-run equilibrium relationships.

2.4 Study Gap

Despite growing literature on taxation, governance and income inequality, important gaps remain. Recent studies predominantly examine tax administration efficiency in relation to revenue mobilisation (Mackenzie *et al*., 2023; Bah, 2024). However, the distributional consequences of tax administration efficiency remain relatively underexplored. Existing studies also examine governance and inequality, often without explicitly considering its interaction with tax administration efficiency. Consequently, whether governance conditions the inequality effects of efficient tax administration remain insufficiently established. Furthermore, much of the existing evidence relies on cross-country panel analyses, which may conceal Nigeria-specific institutional and fiscal dynamics. These limits understanding of how tax administration efficiency operates within Nigeria's unique fiscal and governance environment. The measurement of tax administration efficiency also remains a concern, as individual tax indicators may not adequately capture its multidimensional nature. Moreover, the temporal distinction between short-run and long-run distributional effects has received limited attention. These gaps create a need for country-specific empirical investigation. This study addresses these limitations by constructing a Tax Administration Efficiency Index (TAEI) and examining its effects on income inequality in Nigeria, while incorporating governance, the interaction between tax administration efficiency and governance, government social expenditure, and interest rate. Using a multivariate time-series framework, the study distinguishes short-run dynamics from long-run relationships, providing evidence on the conditional distributional effects of tax administration efficiency in Nigeria.

3. Methodological Process

The study adopts a quantitative approach and *an ex post facto* research design to examine the relationship between tax administration efficiency, governance, and income inequality in Nigeria. Income inequality is measured using the Gini Index obtained from the Standardized World Income Inequality Database (SWIID). The database provides standardized cross-national inequality estimates and documents uncertainty associated with inequality measurement (Solt, 2020). Principal Component Analysis (PCA) is used to construct the TAEI from six indicators: tax-to-GDP ratio, non-oil tax-to-GDP ratio, value-added tax-to-GDP ratio, company income tax-to-GDP ratio, customs and excise duties-to-GDP ratio, and non-oil revenue-to-GDP ratio. PCA reduces correlated indicators to a smaller set of components, but the resulting index remains a proxy whose meaning depends on the indicators and loadings (Jolliffe & Cadima, 2016). Government social

expenditure is measured as real federal government expenditure on education and health, deflated using the GDP deflator and transformed into its natural logarithm.

3.1 Model Specification

The model is grounded in Fiscal Exchange Theory, Institutional Theory, and Optimal Tax Theory. Empirical studies on taxation, governance, and income inequality provide additional support for examining these relationships within Nigeria's institutional and fiscal context. Building on these foundations, the study investigates the effects of tax administration efficiency and governance on income inequality and examines whether governance moderates the relationship between tax administration efficiency and inequality.

$$\mathbf{GINI} = f(\mathbf{TAEI}, \mathbf{GI}, \mathbf{TAEI} \times \mathbf{GI}, lnRGSE, \mathbf{INT}) \quad (3.1)$$

Where:

GINI = Income Inequality (Gini Index)
TAEI = Tax Administration Efficiency Index
GI = Governance Index
TAEI × GI = Interaction term between Tax Administration Efficiency and Governance
GSE = Government Social Expenditure
INT = Interest Rate

The corresponding long-run model is expressed as:

$$GINI_t = \beta_0 + \beta_1 TAEI_t + \beta_2 GI_t + \beta_3 (TAEI_t \times GI_t) + \beta_4 lnRGSE_t + \beta_5 INT_t + \varepsilon \quad (3.2)$$

t represents time t
β_0 = Intercept or constant term.
β_1, β_2, β_3, β_4, and β_5 = Parameters to be estimated, representing the coefficients of the explanatory and control variables.
ε_t = Stochastic error term.

The interaction term is calculated as the product of TAEI and GI to determine whether the relationship between tax administration efficiency and income inequality depends on governance quality.

$$\frac{\partial GINI_t}{\partial TAEI_t} = \beta_1 + \beta_3 GI_t \quad (3.3)$$

A Priori Expectations

Based on the theoretical arguments and the expected distributional effects of the explanatory variables, the study specifies the following a priori expectations:

Table 1. A Priori Expectations

Variable	Expected Sign	A Priori Expectation
TAEI	$\beta_1 < 0$	Higher Tax Administration Efficiency reduces income inequality and poverty.
GI	$\beta_2 < 0$	Better Governance improves equitable distribution and reduces poverty.
TAEI × GI	$\beta_3 < 0$	Good Governance strengthens the poverty- and inequality-reducing effect of Tax Administration Efficiency.
GSE	$\beta_4 < 0$	Increased Government Social Expenditure improves welfare and reduces socioeconomic disparities.
INT	$\beta_5 > 0$	Higher Interest Rates discourage investment and employment, thereby increasing inequality and poverty.

3.2 Methods of Data Analysis

The empirical analysis follows a sequential time-series econometric procedure.

1. Descriptive statistics are examined to establish the distribution, central tendency, dispersion, and general behavior of the variables.
2. The stationarity properties of the series are examined using the augmented dickey-fuller (ADF), Phillips-perron (pp), and Kwiatkowski-Phillips-Schmidt-shin (KPSS) tests at levels and first differences (dickey & fuller, 1979; Phillips & perron, 1988; Kwiatkowski et al., 1992).
3. The optimal lag length for the underlying vector autoregressive (var) system is selected using appropriate information criteria, including the Akaike Information Criterion (AIC), schwarz information criterion (sic), and Hannan-Quinn information criterion (HQ).
4. The Johansen cointegration procedure is applied to determine whether a long-run equilibrium relationship exists among the variables in the system (Johansen, 1988, 1991).
5. The VECM which is adopted as the estimation technique in this study is generally represented generally, as:

$$\delta y_t = \alpha\beta' y_{t-1} + \sum_{i=1}^{p-1} \Gamma_i \, \delta y_{t-i} + \varepsilon_t \quad (3.4)$$

In the present study, the vectors of the endogenous variables are

$$Y_t = \begin{bmatrix} GINI_t \\ TAEI_t \\ GI_t \\ TAEI_GI_t \\ INT_t \\ LNRGSE_t \end{bmatrix} \quad \text{and} \quad Y_{t-1} = \begin{bmatrix} GINI_{t-1} \\ TAEI_{t-1} \\ GI_{t-1} \\ TAEI_GI_{t-1} \\ INT_{t-1} \\ LNRGSE_{t-1} \end{bmatrix} \quad (3.5)$$

Where:

Δ = First-difference operator, Y_t = Vector of endogenous variables at time t, Y_{t-1} = Vector of endogenous variables lagged by one period, α = Matrix of adjustment coefficients indicating the speed at which deviations from long-run equilibrium are corrected, β' = Transpose of the matrix of

cointegrating vectors, representing the long-run equilibrium relationships, Γ_i = Matrix of short-run dynamic coefficients for lag I, $\sum$ = Summation operator, i = Lag index, p = Optimal lag order of the underlying VAR model, ε_t = Vector of error terms or innovations at time \(t\), t = Current time period, and $'$ = Transpose of a matrix or vector.

6. Following estimation, post-estimation diagnostic tests are conducted to assess the adequacy, reliability, and stability of the estimated VECM. Residual diagnostics and stability checks are essential before interpreting dynamic estimates as robust evidence (Lütkepohl, 2005). Serial Correlation Test examines whether the model residuals are correlated across time. The heteroskedasticity test examines whether the variance of the residuals remains constant while the Jarque-Bera test assesses whether the residuals are normally distributed. Model Stability Test examines the stability of the residuals using the roots of the relevant VAR/VECM representation.

7. In addition to these diagnostic tests, Impulse Response Functions (IRFs) and Forecast Error Variance Decomposition (FEVD) are employed to examine the dynamic relationships among the variables.

4. Results and Discussion

4.1 Preliminary Analysis of the GINI Model

Descriptive Statistics

Table 1. Descriptive Statistics of the GINI Model Variables

Statistic	TAEI	GI	TAEI × GI	lnRGSE	INT	GINI
Mean	0.0000	0.0000	-0.6345	13.3617	18.3114	35.3103
Median	-0.2126	0.5919	-0.5522	13.5442	17.5692	36.6000
Maximum	1.8514	1.8048	1.4223	14.2014	31.6500	38.3100
Minimum	-1.6865	-2.3346	-3.4981	10.3595	11.4831	31.4000
Std. deviation	0.9542	1.3346	1.1337	0.7333	4.0907	2.4805
Skewness	0.3484	-0.7288	-0.5866	-2.2523	1.0609	-0.7330
Kurtosis	-0.8577	-0.9760	0.1352	7.0185	2.0723	-1.2868
Jarque-Bera	1.8975	4.4471	1.8970	80.4727	10.1976	5.4043
JB probability	0.3872	0.1082	0.3873	0.0000	0.0061	0.0671
Observations	36	36	36	36	36	36

Source: Authors' Computation, 2026.

The descriptive statistics in Table 1 revealed variations in the distributional properties of the variables used in the GINI model. The mean values of TAEI and GI are zero, reflecting their index construction or standardization, while the interaction term (TAEI × GI) has a mean of −0.6345. Income inequality (GINI) has a mean of 35.3103 and a standard deviation of 2.4805, indicating some variation in inequality over the sample period, although the relatively low dispersion suggests that the series does not fluctuate excessively around its average.

The Governance Index exhibits the highest standard deviation among the standardized index variables, at 1.3346, suggesting relatively greater variability in governance conditions over the study period compared with TAEI. Interest rate also exhibits substantial dispersion, with a standard deviation of 4.0907 and values ranging from 11.4831 to 31.6500, indicating considerable variation in monetary and financial conditions. In contrast, lnRGSE has a standard deviation of 0.7333.

The skewness statistics indicate that lnRGSE is strongly negatively skewed, while interest rate is positively skewed. GINI and GI are also negatively skewed, whereas TAEI displays mild positive skewness. The Jarque-Bera statistics further indicate that lnRGSE and INT depart significantly

from normality at the 5% level, given their respective probabilities of 0.0000 and 0.0061. The normality hypothesis is not rejected for TAEI, GI, and the interaction term. GINI's probability of 0.0671 indicates that its distribution does not significantly depart from normality at the conventional 5% level, although the result is relatively close to the 5% threshold.

Overall, the descriptive statistics indicate that the variables exhibit differing distributional characteristics. The evidence of non-normality in lnRGSE and interest rate suggests that subsequent econometric analysis should rely on appropriate diagnostic procedures to assess the adequacy of the estimated model.

Correlation Analysis

Table 2. Correlation Matrix for the GINI Model

Variable	GINI	TAEI	GI	TAEI × GI	INT	lnRGSE
GINI	1.0000	-0.8138	0.7291	0.5540	-0.6611	0.1452
TAEI	-0.8138	1.0000	-0.5125	-0.3924	0.7529	-0.0163
GI	0.7291	-0.5125	1.0000	0.4364	-0.3840	0.3534
TAEI × GI	0.5540	-0.3924	0.4364	1.0000	-0.322	

Source: Authors' Computation, 2026.

The correlation matrix results in Table 2 above indicates strong linear associations between income inequality and some of the explanatory variables. GINI is strongly negatively correlated with TAEI (−0.8138), suggesting that higher tax administration efficiency is associated with lower income inequality in the sample. Conversely, GINI is positively correlated with governance (0.7291) and the TAEI × GI interaction term (0.5540). These positive associations are descriptive and do not, by themselves, establish the causal effects of governance or the interaction term on income inequality. Interest rate exhibits a relatively strong negative correlation with GINI (−0.6611), while lnRGSE has a weak positive correlation with GINI (0.1452), indicating a comparatively limited linear association between real government social expenditure and income inequality in the sample. Among the explanatory variables, TAEI is strongly positively correlated with interest rate (0.7529), while its correlation with lnRGSE is negligible (−0.0163). Governance is moderately negatively correlated with TAEI (−0.5125), while the interaction term is moderately positively correlated with GI (0.4364). The relatively high correlations involving TAEI and interest rate suggest the possibility of multicollinearity, which is further investigated using the Variance Inflation Factor (VIF). It is important to emphasize that correlation coefficients measure pairwise linear associations and do not account for the joint influence of other variables, temporal dynamics, or potential endogeneity. Consequently, the signs of these correlations should not be interpreted as substitutes for the subsequent econometric estimation.

Multicollinearity Test

The Variance Inflation Factor (VIF) was employed to examine the extent to which linear relationships among the explanatory variables could inflate the variances of the estimated regression coefficients. The test is particularly relevant because the GINI model includes both the governance index and an interaction term between tax administration efficiency and governance.

Table 3. Variance Inflation Factors

Explanatory variable	VIF
TAEI	5.1551
GI	3.4642
TAEI × GI	2.3268
lnRGSE	5.4098
INT	8.3356

Source: Authors' Computation, 2026.

The VIF results in Table 3 indicated that interest rate has the highest VIF value of 8.3356, followed by lnRGSE (5.4098) and TAEI (5.1551). Governance and the interaction term have comparatively lower VIF values of 3.4642 and 2.3268, respectively. Using a VIF threshold of 10, none of the explanatory variables exhibits severe multicollinearity based on the conventional rule of thumb. However, using the more conservative threshold of 5, TAEI, lnRGSE, and interest rate show evidence of moderate to relatively high multicollinearity. This suggests that although the relationships among the explanatory variables may not be sufficiently severe to warrant automatic exclusion of any variable, they could potentially affect the precision and stability of individual coefficient estimates. The findings therefore suggest that the model does not exhibit extreme multicollinearity under the threshold of 10, but some degree of collinearity warrants caution when interpreting the individual coefficients, particularly those associated with TAEI and interest rate. The inclusion term is retained because it is theoretically relevant to examining whether governance conditions modify the relationship between tax administration efficiency and income inequality. of the interaction term

Unit Root Tests

The Augmented Dickey-Fuller (ADF) and Phillips-Perron (PP) tests were employed to investigate the stationarity properties of the variables in the GINI model. The tests were initially conducted at levels to determine whether the variables exhibit unit-root behaviour in their original form.

Table 4. Summary of Unit Root Tests

Variable	ADF level p-value	ADF order	PP level p-value	PP order
TAEI	0.5584	I(1)	0.6967	I(1)
GI	0.5328	I(1)	0.5523	I(1)
TAEI × GI	0.2758	I(1)	0.4038	I(1)
lnRGSE	0.2064	I(1)	0.1272	I(1)
INT	0.1332	I(1)	0.1656	I(1)
GINI	0.6620	I(1)	0.7002	I(1)

Source: Authors' Computation, 2026.

The unit root test results shown in Table 4 indicate that the null hypothesis of a unit root cannot be rejected for any of the variables at levels using either the ADF or PP test at the 5% significance level. All reported level p-values exceed 0.05, suggesting that TAEI, GI, the interaction term, lnRGSE, INT, and GINI are non-stationary in their level forms. The consistency of the ADF and PP results provides preliminary evidence that the variables possess unit-root characteristics at levels. However, these level results alone do not conclusively establish that the variables are integrated of order one, I(1). To confirm their integration order, the unit root tests must also be conducted on their first differences. Variables that become stationary after first differencing can

then be classified as I(1). The findings at levels therefore indicate the need for further stationarity testing at first differences to establish the integration properties of the variables and determine the appropriate framework for investigating long-run relationships among income inequality, tax administration efficiency, governance, government social expenditure, and interest rate.

VAR Lag Length Selection Criteria

Table 5. VAR Lag Length Selection Criteria for the GINI Model

Lag	LogL	LR	FPE	AIC	SC	HQ
0	-251.09	NA	2.3545e-01	15.58	15.85	15.67
1	-123.59	200.90	9.5649e-04	10.04	11.94	10.68
2	-56.23	81.65*	1.8014e-04*	8.14	11.67*	9.33
3	-10.25	39.01	1.9692e-04	7.53*	12.70	9.27*

Source: Author's computation. An asterisk (*) indicates the lag selected by the respective criterion.

The VAR lag selection results indicate mixed preferences across the selection criteria. The sequential modified LR test, Final Prediction Error (FPE), and Schwarz Information Criterion (SC) select lag 2, while the Akaike Information Criterion (AIC) and Hannan-Quinn Information Criterion (HQ) select lag 3 as evident in Table 5. The disagreement among the criteria reflects the trade-off between model fit and parsimony. While the AIC and HQ favour a longer lag structure that may capture additional dynamic information, the LR, FPE, and SC criteria favour a more parsimonious specification with two lags. Given the relatively small sample of 36 observations, the selection of lag 2 may be preferable from a degrees-of-freedom and parsimony perspective, provided that the resulting model satisfies the relevant diagnostic requirements. Consequently, lag 2 represents the lag structure supported by the majority of the reported criteria and may be adopted as the baseline specification for subsequent cointegration and VECM estimation. Nevertheless, the final lag decision should also consider the residual diagnostics, stability properties, and the specific lag convention employed in the cointegration framework.

Johansen Cointegration Test

Table 6. Johansen Cointegration Test

Null hypothesis	Trace statistic	5% CV	Trace p-value	Max-eigen statistic	5% CV	Max-eigen p-value
r = 0	136.2998	95.7537	0.0000	62.3260	40.0776	0.0000
r ≤ 1	73.9737	69.8189	0.0209	34.5539	33.8769	0.0392
r ≤ 2	39.4198	47.8561	0.2320	20.7970	27.5843	0.2780
r ≤ 3	18.6229	29.7971	0.5148	12.7507	21.1316	0.4699
r ≤ 4	5.8722	15.4947	0.7081	5.8711	14.2646	0.6254
r ≤ 5	0.0011	3.8415	0.9731	0.0011	3.8415	0.9731

Source: Authors' Computation, 2026.

The trace statistic rejects the null hypothesis of no cointegration, with a statistic of 136.2998 compared with a 5% critical value of 95.7537 (p=0.0000). The maximum eigenvalue test produces a similar conclusion.

4.2 VECM Estimation Results

Short-run Dynamics: The short-run GINI equation examines how lagged changes in tax administration efficiency, governance, their interaction, interest rate, and real government social expenditure are associated with changes in income inequality, conditional on the error-correction term and the other included regressors.

Table 7. Short-run VECM Estimates for the GINI Equation

Regressor	Coefficient	Std. error	t-statistic	p-value
ECT (CointEq1)	-0.655232	0.093630	-6.998100	0.0000
D(GINI(-1))	-0.107000	0.119628	-0.894435	0.3793
D(TAEI(-1))	0.423554	0.207591	2.040331	0.0516
D(GI(-1))	-1.048673	0.191291	-5.482074	0.0000
D(TAEI × GI(-1))	-0.417934	0.163508	-2.556044	0.0168
D(INT(-1))	0.027517	0.030370	0.906041	0.3732
D(lnRGSE(-1))	0.318747	0.174564	1.825960	0.0794
Constant	31.799848	4.502193	7.063190	0.0000

Source: Authors' Computation, 2026.

The lagged change in GINI is insignificant (β = −0.1070, p = 0.3793), while TAEI is positive but narrowly misses 5% significance (β = 0.4236, p = 0.0516). Governance is negative and significant (β = −1.0487, p < 0.001), as is the TAEI-GI interaction (β = −0.4179, p = 0.0168). LNRGSE is positive but insignificant at 5% (β = 0.3187, p = 0.0794), and interest rate is also insignificant (β = 0.0275, p = 0.3732). Thus, GI and TAE_GI are the statistically significant short-run terms at 5%.

Long-run Cointegrating Relationship: The normalized cointegrating vector from the supplied one-equation VECM is:

$$ECT_{t-1} = GINI_{t-1} + 1.372755\,TAEI_{t-1} - 0.972202\,GI_{t-1} - 1.122469\,(TAEI \times GI)_{t-1} - 0.007215\,INT_{t-1} + 0.909661\,\ln RGSE_{t-1} - 48.009668$$

Rearranging the equation to express GINI as a function of the explanatory variables gives:

$$GINI_t = 48.009668 - 1.372755\,TAEI_t + 0.972202\,GI_t + 1.122469\,(TAEI \times GI)_t + 0.007215\,INT_t - 0.909661\,\ln RGSE_t$$

Table 8. Normalized Cointegrating Relationship (Rank-1 Specification)

Variable in normalized ECT	Coefficient	Std. error	t-statistic
GINI	1.000000	—	—
TAEI	1.372755	0.18996	7.22642
GI	-0.972202	0.13814	-7.03806
TAEI × GI	-1.122469	0.10490	-10.70040
INT	-0.007215	0.03645	-0.19795
lnRGSE	0.909661	0.40396	2.25188
Constant	-48.009668	—	—

Source: Authors' Computation, 2026.

In the normalized long-run equation, TAEI is −1.3728, governance is +0.9722, the interaction is +1.1225, and LNRGSE is −0.9097. The reported t-statistics indicate significance for these terms; interest rate is not statistically distinguishable from zero.

These long-run estimates suggest that TAEI, governance, their interaction, and LNRGSE are associated with the long-run cointegrating relationship, whereas interest rate is not statistically distinguishable from zero based on the reported coefficient statistics.

Error-correction Mechanism

The error-correction coefficient in the GINI equation is -0.6552, with a standard error of 0.0936 and a t-statistic of -6.9981 ($p < 0.001$). The magnitude suggests that approximately 65.52% of the preceding period's disequilibrium is corrected within one annual period, conditional on the supplied specification.

Table 9. VECM Adjustment Coefficients

Dependent difference	Adjustment coefficient	Std. error	t-statistic
D(GINI)	-0.655232	0.09363	-6.99810
D(TAEI)	-0.202507	0.06952	-2.91275
D(GI)	-0.000868	0.11420	-0.00760
D(TAEI × GI)	0.090759	0.13465	0.67403
D(INT)	0.053251	0.33627	0.15836
D(lnRGSE)	0.009568	0.10471	0.09138

Source: Authors' Computation, 2026.

4.3 Post-Diagnostic Tests

Table 10. Post-estimation Diagnostic Tests

Test	Statistic	df / lag	p-value	Conclusion at 5%
VEC residual LM, lag 1	39.70093	36 df	0.3085	No serial correlation detected
VEC residual LM, lag 2	35.23776	36 df	0.5047	No serial correlation detected
VEC residual LM, lag 3	33.84855	36 df	0.5713	No serial correlation detected
VEC residual LM, lag 4	23.86312	36 df	0.9396	No serial correlation detected
Multivariate normality, joint JB	18.919924	12 df	0.0905	Do not reject normality at 5%
Joint VEC residual heteroskedasticity	314.65010	294 df	0.1950	No joint heteroskedasticity detected
Breusch-Pagan-Godfrey, D(GINI) Obs*R^2	5.527612	7 df	0.5959	No heteroskedasticity detected
ARCH-LM, lag 1 Obs*R^2	0.047231	1 df	0.8280	No ARCH effect detected
ARCH-LM, lag 2 Obs*R^2	0.166128	2 df	0.9203	No ARCH effect detected
CUSUM stability	Reported within 5% bounds	—	—	No instability reported
CUSUM of squares	Reported within 5% bounds	—	—	No instability reported
Maximum non-unit root modulus	0.640714	—	—	Below unity

Source: Authors' Computation, 2026.

The diagnostics show no evidence of serial correlation (LM p-values = 0.3085–0.9396), non-normality at 5% (joint $p = 0.0905$), or residual heteroskedasticity ($p = 0.1950$). The maximum non-unit root is 0.6407, and CUSUM tests remain within 5% bounds.

4.4 Dynamic Analysis

Impulse Response Analysis: The impulse response function (IRF) was used to examine the response of GINI to a shock in tax administration efficiency over a ten-period horizon.

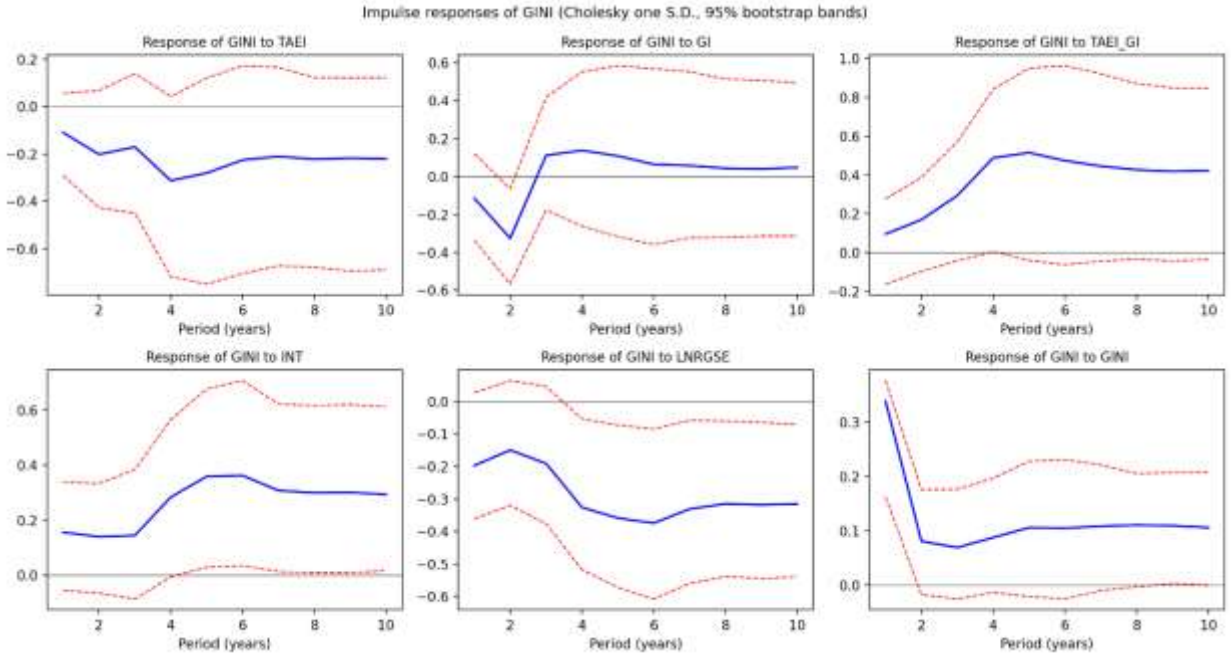
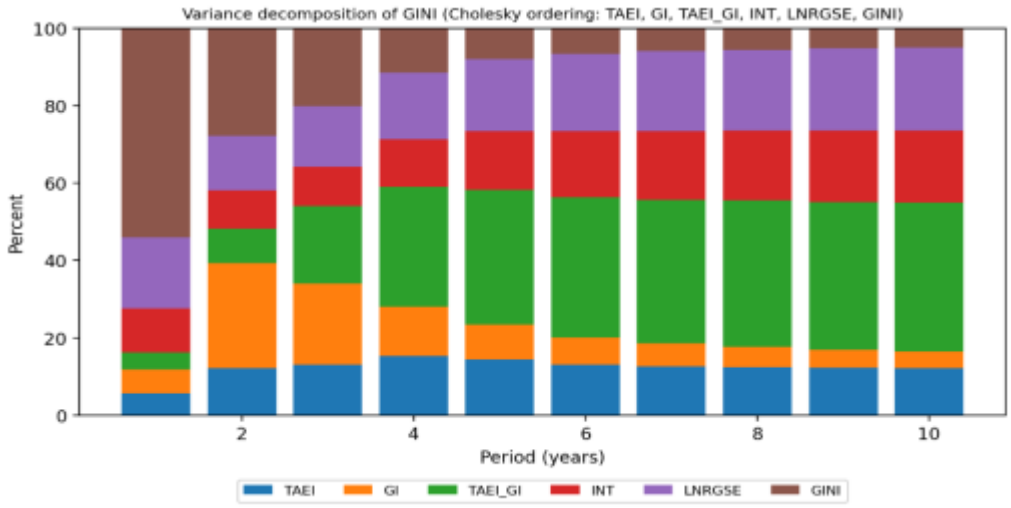


Figure 1: Impulse Response of GINI to a Shock in TAEI

Source: Author's computation.

The reported response falls to about −0.07 in period one and rises to about 0.10 in period two; confidence bands reportedly cross zero throughout

Forecast Error Variance Decomposition: Forecast Error Variance Decomposition (FEVD) was used to examine the relative contributions of innovations in the variables to the forecast error variance of GINI over the forecast horizon.



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Figure 2: Forecast Error Variance Decomposition

Source: Authors' Computation, 2026.

The supplied interpretation of the FEVD indicates that GINI's own innovations account for nearly all of its forecast error variance at the initial horizon. As the horizon increases, the contribution of GINI's own shocks declines, while the contributions of governance, the interaction term, interest rate, and real government social expenditure increase. The direct contribution of TAEI is reported to remain comparatively small.

4.5 Discussion of Findings.

Tax Administration Efficiency, Governance and Income Inequality

The positive but insignificant short-run effect of tax administration efficiency suggests that improvements in revenue administration do not immediately translate to reduced income inequality. This contrasts with the fiscal-capacity emphasis of Mackenzie *et al*. (2023), who identified substantial inefficiencies in African tax administrations, and Bah (2024), who found institutional quality significantly improves tax revenue mobilization across Sub-Saharan Africa. However, revenue mobilization does not necessarily guarantee equitable income distribution, particularly where tax incidence and redistribution remain weak. The result therefore reinforces the distinction between administrative efficiency and distributional effectiveness.

Governance and Income Inequality

Governance exhibits a negative and significant short-run relationship with income inequality, but a positive normalized long-run coefficient. The short-run result aligns with Onatunji (2025), who found institutional quality reduces inequality in Sub-Saharan Africa, but contrasts with Dossou et al. (2023), who reported that governance quality exacerbates inequality. These divergent findings may reflect differences in institutional effectiveness, policy implementation, country heterogeneity, and the capacity of governance structures to translate public resources into inclusive outcomes. The contrasting short- and long-run estimates in this study further suggest that the distributional effects of governance in Nigeria may be time-dependent.

The Interaction between Tax Administration Efficiency and Governance

The negative and significant short-run interaction coefficient (−0.4179; p = 0.0168) indicates that governance conditions the distributional relationship between tax administration efficiency and income inequality. This supports Voto and Ngepah (2024), whose findings show that governance moderates the inequality-enhancing effect of personal income tax, with stronger governance reducing its adverse distributional impact. However, the positive normalized long-run interaction coefficient suggests that this relationship may change over time. This divergence may reflect institutional persistence, changing tax incidence, and weaknesses in converting improved revenue administration into sustained redistributive outcomes. The result highlights governance as a critical condition for the distributional effectiveness of tax administration rather than merely an independent determinant of inequality.

Government Social Expenditure and Interest Rate

Government social expenditure has a positive but insignificant short-run effect, while its normalized long-run coefficient is negative and statistically significant. This is consistent with Onatunji (2025), who found that government expenditure reduces inequality in Sub-Saharan Africa in both the short and long run. The insignificant short-run effect may reflect implementation delays, poor targeting, and the time required for social expenditure to improve access to education, healthcare, and other welfare-enhancing services. The long-run result therefore suggests that

sustained social spending may be more distributionally effective than immediate expenditure expansion. Interest rate has a positive but insignificant short-run coefficient, indicating insufficient evidence of an immediate distributional effect. Its insignificance may reflect the indirect transmission of monetary policy through investment, employment, credit access, and household income, rather than a direct effect on inequality within the study period.

5. Conclusion and Policy Recommendations

Conclusion

This study examined the effects of tax administration efficiency and governance on income inequality in Nigeria, with particular attention to the moderating role of governance. The provisional results indicate that tax administration efficiency and governance are relevant to understanding the dynamics of income inequality in Nigeria. This finding suggests that the relationship between tax administration efficiency and income inequality may depend on the quality of governance. Real government social expenditure had a positive short-run coefficient, but the effect was not statistically significant at the 5% level. The preliminary long-run estimates suggest that tax administration efficiency, governance, their interaction, and real government social expenditure are associated with income inequality, although the estimated directions differ from some short-run relationships. In conclusion, the findings suggest that improving tax administration alone may not be sufficient to address income inequality.

Policy Recommendations

Based on the provisional findings, the study recommends the following:

1. Strengthen tax administration and compliance: The government should improve tax collection systems, simplify tax procedures, expand digital tax services, and enforce compliance to reduce tax evasion and improve revenue mobilization.

2. Improve government effectiveness and accountability: Public institutions should strengthen transparency, reduce corruption, and ensure that public officials are accountable for their decisions. Effective governance can help create conditions under which efficient tax administration contributes to better distributional outcomes.

3. Link revenue mobilization to equitable public spending: Increased tax revenue should be directed toward public services and social programs that benefit low-income and vulnerable groups, such as education, healthcare, and social protection. This can help ensure that revenue mobilization supports efforts to reduce income inequality.

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