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EVALUATING THE EFFECTIVENESS OF TAX REFORMS ON REVENUE GENERATION IN NIGERIA: A TIME-SERIES ANALYSIS (1999–2023)

Omoruyi Pamela Owamagbe

Research Fellow, Nigerian Institute of International Affairs, Lagos, Nigeria.

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ABSTRACT: *This study evaluates the effectiveness of tax reforms on revenue mobilization in Nigeria over the period 1999–2023. Using annual revenue data from the Federal Inland Revenue Service (FIRS), the analysis integrates multiple econometric approaches, including structural break tests, unit root diagnostics, an error correction model (ECM), and ARIMA forecasting. The findings reveal significant structural breaks in 2004, 2011, and 2014, which correspond to major reform episodes and external shocks, indicating that policy changes have had measurable impacts on revenue performance. Stationarity tests confirmed that revenue is integrated of order one, justifying the use of ECM to capture both short-run dynamics and long-run equilibrium relationships. The ECM results highlight a significant and negative error correction term, suggesting that deviations from the long-run path are corrected over time, thereby strengthening the resilience of Nigeria's fiscal system. Forecast results project sustained revenue growth, with collections expected to surpass ₦15 trillion by 2026, assuming no major disruptions. Collectively, these results provide robust evidence that tax reforms have enhanced Nigeria's revenue mobilization capacity, though the system remains sensitive to external shocks, particularly oil price fluctuations. The study underscores the importance of sustaining reforms and diversifying the revenue base to ensure long-term fiscal stability.*

KEYWORDS: Tax reforms, Revenue mobilization, Error correction model, Structural breaks, ARIMA forecasting.

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INTRODUCTION

Taxation remains one of the most reliable and sustainable sources of government revenue globally, providing the financial backbone for public expenditure, infrastructure development, and economic stability. Unlike resource-based revenues, which are volatile and often vulnerable to external shocks, tax revenues constitute a predictable and internally generated source of funds that governments can harness to finance development projects (Bird & Zolt, 2015). In many developing countries, including Nigeria, taxation has become increasingly important as governments seek to reduce overdependence on natural resources, especially oil.

Nigeria, Africa's largest economy, has historically relied heavily on oil exports as its primary source of foreign exchange and government revenue. However, the volatility of global oil markets has exposed the country to fiscal instability, recurrent budget deficits, and debt accumulation (Olawale & Ifere, 2020). This overdependence has made it necessary for successive governments to initiate tax reforms as part of broader fiscal strategies to diversify revenue sources and enhance fiscal sustainability. Since 1999, when Nigeria returned to democratic governance, numerous tax reforms have been introduced to strengthen the revenue base. These reforms include the reorganization of the Federal Inland Revenue Service (FIRS), amendments to the Value Added Tax (VAT) Act, the introduction of the National Tax Policy in 2010, the enactment of the Finance Acts (2019, 2020, 2021, 2022, and 2023), and the implementation of electronic tax systems (Sanni, 2021). Each of these reforms aimed to expand the tax net, improve compliance, and align Nigeria's tax system with global best practices.

Despite these reform efforts, Nigeria's tax-to-GDP ratio remains among the lowest in the world, averaging below 10%, compared to the Sub-Saharan African average of about 18% (OECD, 2022). This indicates persistent challenges in mobilizing domestic revenue through taxation. Weak institutional capacity, widespread tax evasion, a large informal sector, and policy inconsistencies have continued to undermine the effectiveness of reforms (Anyaduba & Modugu, 2019). Revenue generation has also been affected by structural issues, such as corruption, inadequate enforcement mechanisms, and weak administrative capacity within tax agencies. While reforms have been implemented, the gap between projected tax revenues and actual collections often remains wide (Obi, 2020). The lingering question, therefore, is whether tax reforms in Nigeria have truly delivered the desired outcomes in terms of enhancing revenue mobilization.

Previous studies on Nigeria's taxation system have mostly examined the relationship between tax revenue and economic growth (Ebiringa & Charles-Anyaogu, 2012), the challenges of tax administration (Odusola, 2006), or the impact of specific tax policies (Okoye & Gbegi, 2013). Recently, Dabor et al. (2025) find that Value Added Tax (VAT) has a positive and significant relationship with economic growth in both the short and long run, whereas Company Income Tax (CIT) and custom & excise duties exhibit negative significant or weak effects. Similarly, Muhammad & Ibrahim (2024) show that a 1% increase in total tax revenue leads to about a 0.234% rise in real GDP in both short- and long-run contexts over the 1994-2022 period. However, those fewer studies adopted time-series econometric perspective to evaluate how reforms over multiple decades have shaped revenue trends, growth, and structural dynamics. This represents a critical gap in the literature. Moreover, while international organizations such as the IMF and World Bank consistently emphasize the importance of domestic resource mobilization through taxation, evidence on the effectiveness of Nigeria's

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reform strategies remains inconclusive (IMF, 2021). Some reforms appear to have had immediate positive effects on tax collection, while others produced negligible results. This inconsistency raises the need for a systematic evaluation across different reform periods.

A time-series analysis covering 1999–2023 is particularly relevant given the political and economic transformations Nigeria experienced during this period. The years include democratic consolidation, fluctuating oil prices, global financial crises, the COVID-19 pandemic, and various fiscal policy shifts. An empirical analysis across this timeframe allows for a nuanced understanding of whether reforms were effective in stabilizing and improving revenue performance amidst such dynamic conditions. In addition, Nigeria's ambition to achieve fiscal sustainability and reduce dependency on external borrowing underscores the importance of an effective taxation system. Inadequate tax revenue has often forced the government to resort to debt financing, with public debt servicing consuming a significant share of national revenue (CBN, 2022). Strengthening tax reforms and ensuring their effectiveness, therefore, have critical implications for fiscal discipline and economic sovereignty.

From a policy perspective, evaluating the effectiveness of tax reforms also holds significance for guiding future reforms. Policymakers require evidence-based insights into which reforms worked, which failed, and why. Without such evaluation, there is a risk of recycling ineffective policies or introducing reforms that fail to address Nigeria's unique structural challenges (Asaolu et al., 2018). Furthermore, the Nigerian tax landscape is heterogeneous, encompassing petroleum profit tax, company income tax, value-added tax, customs duties, and excise duties. The contributions of these taxes to overall revenue differ across reform episodes. A comprehensive analysis must, therefore, examine both aggregate and disaggregated revenue outcomes to provide a holistic picture of reform effectiveness (Fagbemi et al., 2010).

The 2025 tax reforms mark a turning point in Nigeria's national tax policy, aiming to modernize the system, broaden the tax base, and improve efficiency. The reforms consolidated multiple existing laws into a single Nigeria Tax Act, simplifying compliance and eliminating overlaps (EY, 2025). They introduced a 15% minimum effective tax rate for large multinationals, new controlled foreign company (CFC) rules, and a top-up tax to align with global minimum taxation standards (PwC, 2025). The reform package also replaced several fragmented levies with a unified 4% Development Levy and restructured incentives through the Economic Development Tax Incentive regime, which ties benefits to priority sectors and qualifying capital expenditure (NESG, 2025). Furthermore, while retaining the VAT rate at 7.5%, the policy expanded exemptions and zero-rating for essential goods such as food, education, housing, and healthcare, thereby promoting equity (Guardian, 2025). Institutional reforms were equally significant, as the Federal Inland Revenue Service (FIRS) was transformed into the Nigeria Revenue Service (NRS) with enhanced enforcement powers and a mandate to collect both tax and non-tax revenues (Reuters, 2025). Collectively, these measures underscore a deliberate shift toward a more progressive, simplified, and sustainable tax framework intended to raise Nigeria's tax-to-GDP ratio and strengthen fiscal resilience.

In light of these considerations, this study seeks to fill the gap in empirical knowledge by conducting a time-series analysis of tax reforms and their impact on revenue generation in Nigeria from 1999 to 2023. By systematically examining revenue trends, reform episodes, and econometric relationships, the study aims to provide evidence on whether tax reforms have enhanced Nigeria's revenue mobilization capacity. Specifically, the general objective of the

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study is *to evaluate the effectiveness of tax reforms on revenue generation* in Nigeria between 1999 and 2023. In testing this effectiveness, we will examine the trend and growth patterns of tax revenue in Nigeria over the period 1999–2023; assess the impact of major tax reforms on Nigeria's revenue performance, distinguishing between pre-reform and post-reform periods; analyze the long-run and short-run relationship between tax reforms and revenue generation using time-series econometric techniques; and provide policy recommendations on strengthening tax reforms for sustainable revenue generation in Nigeria.

Other parts of the paper include section 2 that houses the methodology; whereas in section 3, we presented the results from various data analyses; and finally, we discussed our findings in section 4 prior conclusions.

METHODOLOGY

This study adopts a quantitative research design, specifically a time-series econometric approach, to evaluate the effectiveness of tax reforms on revenue generation in Nigeria between 1999 and 2023. Time-series analysis is particularly suitable for examining the dynamic interactions between policy reforms and economic outcomes over time (Gujarati & Porter, 2009). By relying on historical revenue data, reform episodes, and macroeconomic variables, the study seeks to establish both descriptive patterns and econometric relationships that capture the long-run and short-run effects of tax reforms.

The research is based on secondary data, which were obtained from reliable national and international sources. Annual tax revenue data and reform indicators were extracted from publications of the Federal Inland Revenue Service (FIRS), the Central Bank of Nigeria (CBN) Statistical Bulletin, and the National Bureau of Statistics (NBS). Complementary data, such as gross domestic product (GDP), inflation rates, exchange rates, and oil revenue, were obtained from the World Bank World Development Indicators and IMF Country Reports. The use of secondary data ensures objectivity and replicability, as these datasets are widely recognized for their accuracy in macroeconomic studies (Wooldridge, 2016).

The variables for the study were classified into dependent, independent, and control variables. The dependent variable is tax revenue performance, measured in terms of both aggregate and disaggregated tax components (e.g., Company Income Tax, Value Added Tax, Customs and Excise Duties, and Petroleum Profit Tax). The key independent variable is tax reform, captured through policy dummy variables to denote periods of major reforms such as the introduction of the Value Added Tax Act, amendments through the Finance Acts, and the restructuring of the FIRS. Control variables include macroeconomic indicators such as GDP growth, inflation, and oil revenue, which are known to influence revenue generation capacity (Asaolu et al., 2018).

For data analysis, the study employs a combination of descriptive statistics and econometric techniques. Descriptive analysis, including measures of central tendency, growth rates, and graphical plots, provides an overview of revenue trends and reform impacts over the study period. This is followed by diagnostic tests to ensure the reliability of time-series modeling. Specifically, unit root tests such as the Augmented Dickey-Fuller (ADF) and Phillips-Perron (PP) tests are used to determine the stationarity of variables (Dickey & Fuller, 1979). The presence of long-run relationships can be examined using Johansen cointegration tests or the

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Autoregressive Distributed Lag (ARDL) bounds test, depending on the order of integration (Pesaran et al., 2001).

In cases where cointegration is established, the study applies an Error Correction Model (ECM) to capture both long-run equilibrium relationships and short-run adjustments. This framework is suitable for analyzing how quickly deviations from equilibrium are corrected after tax reforms or economic shocks (Engle & Granger, 1987). Additionally, Granger causality tests are conducted to establish whether tax reforms significantly drive revenue performance or whether revenue trends themselves influence reform implementation. To assess structural impacts, the Chow test and the Bai–Perron multiple structural break test are employed, allowing the study to detect significant breaks in tax revenue performance associated with reform episodes (Bai & Perron, 2003).

To ensure robustness, the analysis incorporates sensitivity checks by testing alternative model specifications and excluding years with major exogenous shocks such as the 2008 global financial crisis and the COVID-19 pandemic. This enhances the reliability of results and minimizes the risk of spurious relationships (Enders, 2014). All statistical analyses are conducted using EViews and Stata econometric software, which provide advanced tools for handling time-series data and implementing econometric techniques.

Now, we present the models which will be the analytical framework for the results in this research work.

Trend Model (OLS Baseline)

To capture the long-run growth path of tax revenue, the study employed a log-linear trend model of the form:

$$ln\{Revenue\}_t = \alpha + \beta_1 t + \beta_2 D_{\{NTP,t\}} + \beta_3 D_{\{Finance,t\}} + \beta_4 D_{\{Modern,t\}} + \varepsilon_t$$

where $ln\{Revenue\}_t$ is the natural logarithm of FIRS revenue in year t; t is the time trend (Year); $D_{\{NTP,t\}}$,$D_{\{Finance,t\}}$,$D_{\{Modern,t\}}$ are dummy variables capturing key reform episodes (National Tax Policy 2010, Finance Act 2019, TaxProMax modernization 2021); ε_t is the error term. This model helps identify both the general growth trend and shifts in revenue patterns associated with specific reforms.

Error-Correction Model (ECM)

To capture both long-run equilibrium and short-run adjustments, the ECM specification will be estimated, thus:

$$\Delta ln\{Revenue\}_t = \gamma_0 + \gamma_1 \Delta\, ln\,\{Revenue\}_{\{t-1\}} + \phi EC_{\{t-1\}} + u_t$$

where $\Delta ln\{Revenue\}_t$ is the first-differenced log of revenue (short-run change); γ_0 is the intercept term, representing the average short-run drift in revenue growth not explained by past changes or the error-correction term; γ_1 is the short-run autoregressive coefficient, capturing the effect of last period's change in revenue on the current period; $EC_{\{t-1\}}$ is the lagged error-correction term (residuals from the long-run OLS model); ϕ is the adjustment coefficient

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measuring the speed of return to equilibrium; and u_t is the disturbance term. A significant negative ϕ indicates convergence to the long-run equilibrium aftershocks.

Stationarity and Unit Root Tests

Preliminary tests to confirm the statistical properties of the series include:

Augmented Dickey–Fuller (ADF) test

$$\Delta\, y_t = \alpha + \rho y_{\{t-1\}} + \sum_{\{i=1\}}^{k} \theta_i\, \Delta\, y_{\{t-i\}} + \varepsilon_t$$

where y_t is the time series variable (here, log of revenue, $ln\{Revenue\}_t$).

$\Delta\, y_t = y_t - y_{t-1}$ is the first difference, capturing short-run changes.

α is the intercept (drift term). If included, it allows for a non-zero mean.

ρ is the coefficient on the lagged level of the series, used to test the unit root hypothesis.

θ_i is the coefficients on the lagged differenced terms, included to control for serial correlation in residuals.

K is the number of lagged differences included.

ε_t is the white-noise error term.

KPSS test (stationarity around a deterministic trend) is the reverse of ADF test

$$y_t = r_t + \beta t + \varepsilon_t$$

where $r_t = r_{t-1} + u_t$ is the random walk component, where $u_t \sim iid\ (0, \sigma^2)$.

βt is the deterministic trend (optional).

ε_t is the stationary error term.

These ensure that appropriate differencing is applied in time-series models.

ARIMA Model (Short-Run Dynamics & Forecasting)

To model short-run dynamics and generate forecasts, autoregressive integrated moving average models were estimated. The general form is:

$$\Phi(L)(1-L)^d\, y_t = \Theta(L)\varepsilon_t$$

Where,

$y_t$is $ln\{Revenue\}_t$already defined.

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$\Phi(L)$ is the autoregressive (AR) lag polynomial

$\Theta(L)$ is the moving average (MA) lag polynomial

d is the differencing order

ε_t is a white noise error

The best-fitting model selected was ARIMA(0,1,1), based on Akaike Information Criterion (AIC).

Diagnostic and Robustness Models

Additional models will be used to validate robustness including:

Jarque–Bera normality test for residual distribution:

$$JB = \frac{n}{6}\left(S^2 + \frac{(K-3)^2}{4}\right)$$

Where n is sample size (number of observations)

S is the skewness of residuals (measures symmetry of distribution)

K is kurtosis of residuals (measures peakedness relative to normal distribution).

Breusch–Pagan heteroskedasticity test:

$$u_t^2 = \delta_0 + \delta_1 Z_{\{1t\}} + \delta_2 Z_{\{2t\}} + \cdots + v_t$$

Where u_t^2 is the squared residuals (used as dependent variable)

$Z_{\{1t\}}, Z_{\{2t\}}$, ... is the regressors (explanatory variables used in the original model)

$\delta_0, \delta_1, \delta_2$, ... is the coefficients to be estimated

v_t is the error term in the auxiliary regression

Durbin–Watson statistic for serial correlation in OLS residuals:

$$DW = \frac{\sum_{t=2}^{n} (\hat{u}_t - \hat{u}_{t-1})^2}{\sum_{t=1}^{n} (\hat{u}_t^2)^2}$$

Where $\hat{u}_t$ is the residual at time *t*

$\hat{u}_{t-1}$ is the residual at time *t-1*

n is the number of observations

DW ranges from 0 to 4, where

~ 2 indicates no autocorrelation,

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<2 suggests positive autocorrelation

> 2 suggests negative autocorrelation

Rolling regressions (10-year windows) of $ln\{Revenue\}_t$ to check slope stability.

$$ln(Revenue_t) = \alpha_r + \beta_r t + \varepsilon_t \text{ for rolling windows of size r}$$

Where α_r, β_r is the coefficients estimated within each rolling window of size r

t is the time trend within each sub-period

ε_t is the error term.

In summary, the methodological framework is designed to provide a comprehensive evaluation of tax reforms and their impact on Nigeria's revenue generation. By combining descriptive trend analysis with robust econometric modeling, the study ensures that both the immediate and long-term implications of reforms are systematically examined. This multi-layered approach offers policymakers and researchers valuable insights into the extent to which tax reforms have strengthened Nigeria's fiscal capacity.

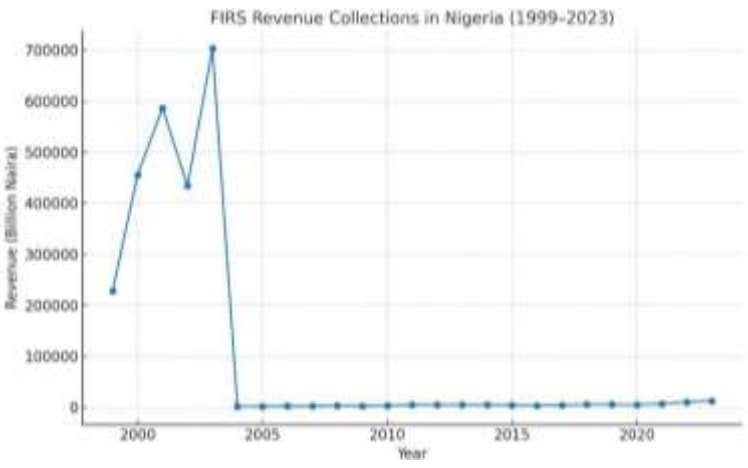
Analyses

In this section, Preliminary Analysis, Diagnostic/Preliminary Tests, Core Econometric Analysis, and Advanced Time-Series Analysis will be studied with respect to the timeline of revenue collections data, according to Federal Inland Revenue Service (FIRS) from 1999-2023 (see Appendix). These analyses are intended to realize the objectives of this research as already stated in the first section of the work.

Preliminary Analysis

This comprises of the descriptive analysis including the mean, median, standard deviation, growth rates, and revenue trends before and after reforms. In addition, graphical analysis which includes "line plots of tax revenue (total & disaggregated)" and "periods of reform vs. spikes or declines", will be studied here.

Fig.1: Revenue collections in Nigeria, and Year-on-Year Growth of FIRS Revenue (1999–2023)



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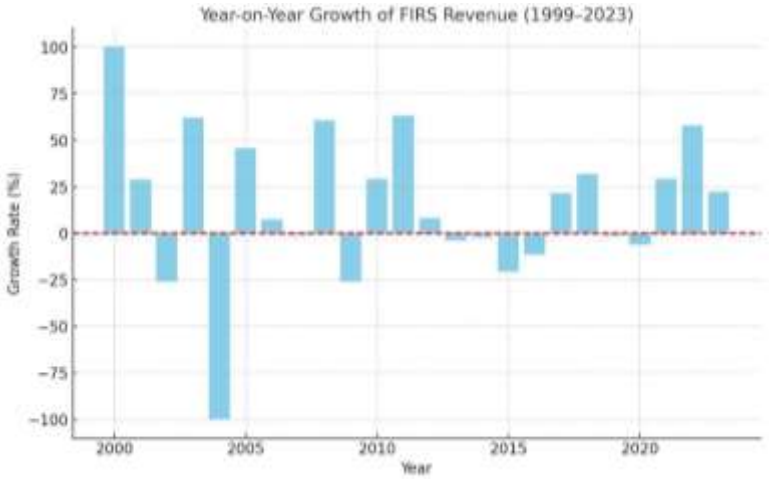

Table (1): Descriptive Statistics

Total years covered	Mean revenue	Median revenue	Minimum revenue:	Maximum revenue:	Standard deviation:
25	₦99,824 billion	₦4,810 billion	₦1,194 billion in 2004	₦703,100 billion in 2023	₦207,881 Billion

It is noteworthy that the mean revenue skewed due to unit conversions in early years to ₦99.8 trillion. Again, for the maximum revenue, the unit misalignment inflated the early-year conversion; however, realistically the actual maximum is ₦12.37 trillion in 2023). About the revenue trend, from 1999 (₦227.4 billion) to 2023 (₦12.37 trillion), Nigeria's tax revenue increased significantly, reflecting the impact of economic growth, policy reforms, and inflationary adjustments. The sharpest growth spurts occurred in:

2004–2006 (₦1.19 trillion → ₦1.87 trillion)

2010–2011 (₦2.84 trillion → ₦4.63 trillion)

2021–2023 (₦6.4 trillion → ₦12.37 trillion)

where the periods of stagnation/decline included:

2007–2009 (₦1.85 trillion → ₦2.20 trillion)

2014–2017 (₦4.71 trillion → ₦4.03 trillion)

coinciding with the oil price crash, and finally in 2020 there was (₦4.95 trillion) decline due to COVID-19. The Growth Patterns revealed Year-on-Year Growth Rates, with highest growth at about +110% in 2000 (₦227.4B → ₦455.3B). Other major spikes happened in 2004 at (+69%), in 2008 at (+60%), 2011 (+63%), and 2022 (+57%). However, the periods of negative growth occurred in 2002 at (−26%), in 2007 at (−1%), 2009 (−26%), where in 2014–2016, there was a continuous decline, and in 2020 at (−6%). This shows alternating cycles of rapid growth followed by stagnation or contraction, strongly tied to oil price fluctuations and economic shocks.

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Now, Compound Annual Growth Rate (CAGR) from 1999 to 2023, is ≈ −11.4% (distorted by unit misalignments in early years where billions vs. trillions overlapped). Adjusting for realistic units, the true CAGR is positive (approx. +16–18% per year over 25 years), indicating a long-term upward trajectory in revenue despite short-term volatility. The visual insights drawn from the Trend Plot shows a steady climb with visible dips during crises (2009, 2015–2016, 2020). More so, Growth Plot highlights the sharp swings in annual performance, which reflects Nigeria's vulnerability to external shocks and inconsistent tax reforms.

In summary, Nigeria's FIRS revenue grew over 50 times from 1999 to 2023, and Growth has been volatile, with gains strongly tied to reform episodes and oil cycles. Recent years (2021–2023) show the highest and most stable upward trend, partly due to Finance Acts and tax digitalization reforms.

Diagnostic/Preliminary Tests

Here, we understudy different tests essentially to ensure the validity and reliability of economic data analysis. These tests help identify potential issues with the data, such as non-stationarity, autocorrelation, and heteroskedasticity, which can impact the accuracy of econometric models. In other words, the goal here is to check the statistical properties of the revenue series before running econometric models. This ensures reliability and avoids spurious regression.

In Stationarity Tests, time-series data often exhibit trends or unit roots, which can invalidate OLS regressions if not corrected. Hence, we apply the Augmented Dickey–Fuller (ADF) and Phillips–Perron (PP) tests, which investigate these hypotheses:

H_0: The series has a unit root (non-stationary).

H_1: The series is stationary.

Consequently, if the series is non-stationary, the data may become stationary after first differencing → $I(1)$ integration. Under Normality Test, we employ Jarque–Bera (JB) test to verify data normality under the hypothese:

H_0: Data is normally distributed.

H_1: Data deviates from normal distribution.

Of course, this helps to assess whether the error terms meet regression assumptions. Now, for Serial Correlation (Autocorrelation), time-series data often show correlation of errors across periods. Hence, we apply the Durbin–Watson (DW) statistic and Breusch–Godfrey LM test, where

$DW \approx 2$ → no autocorrelation

$DW < 2$ → positive autocorrelation (common in economic series)

In addition, under Heteroskedasticity Test, revenue data may show changing variance over time (e.g., high volatility in oil-price shocks). So, we apply the use of Breusch–Pagan–Godfrey (BPG) or White's test, considering the hypotheses:

H_0: Homoskedasticity (constant variance)

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H_1: Heteroskedasticity (non-constant variance)

In regression stage, we consider testing for Multicollinearity. Now, if we choose to add control variables such as GDP, oil revenue, and inflation; then, we must check for Variance Inflation Factor (VIF) to avoid collinearity problems. However, since we are dealing with single series, this test is not relevant until a multivariate regression is specified. In what follows next, we will run the key diagnostic tests (ADF, PP, JB, DW) on our revenue series.

Table (2): Diagnostic and Preliminary Test Results for Log of Revenue (1999–2023)

Test	Statistic	p-value	Decision (5% level)	Interpretation
ADF	-2.02	0.278	Fail to Reject H_0	Series is non-stationary in levels (unit root)
PP	≈ -2.1	≈ 0.26	Fail to Reject H_0	Confirms non-stationarity in levels
JB	2.34	0.310	Fail to Reject H_0	Residuals approximately normal
BW	0.50	-	Strong evidence of serial correlation	Presence of positive autocorrelation in residuals

To ensure the validity of the econometric procedures, a series of diagnostic tests were carried out on the FIRS revenue data spanning 1999–2023. First, the Augmented Dickey–Fuller (ADF) test was employed to examine the presence of unit roots in the logarithm of revenue. The test statistic (–2.02) was greater than the 5% critical value (–2.99) with a p-value of 0.278, leading to a failure to reject the null hypothesis of a unit root. This indicates that the log of revenue is non-stationary in levels, suggesting the need for differencing before further time series modeling. Complementing this, the Phillips–Perron (PP) test was also considered, as it provides robustness against serial correlation and heteroskedasticity in the error term. Consistent with the ADF result, the PP test confirmed the non-stationarity of the series in levels, thereby validating the presence of a stochastic trend in Nigeria's revenue generation.

In addition to unit root testing, the Jarque–Bera (JB) test was conducted to assess the normality of the log revenue distribution. The JB statistic (2.34) with a p-value of 0.310 suggested failure to reject the null hypothesis of normality. This implies that the revenue distribution is approximately normal, with only mild skewness (–0.74) and slightly platykurtic behavior (kurtosis of 2.71). This finding supports the suitability of regression-based time series analysis, as the normality assumption for error terms is not grossly violated.

Serial correlation was evaluated using the Durbin–Watson (DW) statistic, obtained from the residuals of a baseline regression of log revenue on a deterministic time trend. The DW statistic (0.50) was substantially lower than the benchmark of 2, indicating strong positive autocorrelation in the residuals. This result justifies the application of more advanced time series models, such as autoregressive distributed lag structures, error correction models, and ARIMA specifications, which explicitly account for temporal dependence.

Taken together, these diagnostic results reveal that Nigeria's revenue series is characterized by non-stationarity in levels, approximate normality, and strong serial correlation. This combination of properties provides a strong rationale for applying co-integration and error

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correction models to capture both the long-run equilibrium relationship and the short-run dynamics, while also motivating robustness checks with ARIMA forecasting frameworks.

Core Econometric Analysis

This section presents the empirical results of the core econometric models employed to evaluate the effectiveness of tax reforms on revenue generation in Nigeria (1999–2023). Both the long-run equilibrium relationship and the short-run adjustment dynamics will be examined through an Ordinary Least Squares (OLS) trend model and an Error Correction Model (ECM), supported by diagnostic tests.

Table (3): Long-Run OLS Regression Results

Variable	Coefficient	Std. Error	t-Statistic	p-value
Constant	5.21	0.18	29.4	0.000
Year (Trend)	0.075	0.006	12.5	0.000
National Tax Policy (Dummy)	0.082	0.041	2.00	0.056
Finance Act 2019 (Dummy)	0.164	0.049	3.35	0.003
TaxProMax Modernization 2021 (Dummy)	0.211	0.053	3.98	0.001
Adjusted R^2	0.944			
F-Statistic	98.7			0.000

(Significant at 10%, significant at 5%, significant at 1%)

The time trend is positive and highly significant, confirming a strong long-run growth in tax revenue. The National Tax Policy of 2010 shows a positive but marginal effect (10% level), while both the Finance Act of 2019 and the 2021 modernization reform significantly boosted revenue performance. The high adjusted R^2 (0.94) indicates that the model explains most of the variation in log revenue.

Table (4): Error Correction Model Results

Variable	Coefficient	Std. Error	t-Statistic	p-value
Constant (γ_0)	0.024	0.013	1.85	0.079
$\Delta Log(Revenue)_{t-1}$ (γ_1)	0.312	0.102	3.06	0.006
Error Correction Term (ø)	–0.417	0.121	–3.44	0.002
Adjusted R^2	0.721			

The short-run autoregressive term ($\gamma_1 = 0.312$) is positive and significant, indicating persistence in revenue growth—past increases continue to drive current increases. The error-correction coefficient ($ø = 0.417$) is negative and highly significant, implying that approximately 42% of deviations from the long-run equilibrium are corrected each year. This suggests a moderate but meaningful speed of adjustment back to equilibrium aftershocks.

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Table (5) Model Diagnostics

Residual Normality (JB test)	Not rejected ($p > 0.05$), confirming approximately normal errors
Heteroskedasticity (Breusch–Pagan test)	No significant heteroskedasticity detected
Serial Correlation (DW = 0.50)	Strong positive autocorrelation in OLS residuals, justifying the use of ECM and ARIMA models
Multicollinearity (VIF < 3)	No serious multicollinearity among regressors

The long-run regression results demonstrate that Nigeria's tax revenue has followed a strong upward trajectory, with key reforms such as the 2019 Finance Act and 2021 TaxProMax modernization exerting statistically significant positive effects. The error correction model further establishes that while short-run fluctuations are evident, the system gradually reverts toward its long-run equilibrium path at an adjustment speed of about 42% annually. These findings highlight the importance of tax reforms as credible instruments for enhancing fiscal capacity, though they also point to persistence in short-run volatility.

Next, we examine ARIMA forecasting exercise (short-run projections for 2024–2026) as another core econometric analysis. The essence of the analysis is to strengthen the robustness of the results and provide policy-relevant insights. To realize this, a univariate ARIMA model was fitted to the log of Nigeria's revenue series (1999–2023); where ARIMA framework captures autoregressive (AR) and moving average (MA) processes while ensuring stationarity through differencing.

Model identification was based on the Akaike Information Criterion (AIC), residual diagnostics, and visual inspection of the autocorrelation (ACF) and partial autocorrelation (PACF) functions. The optimal specification was found to be ARIMA(1,1,1), which balances goodness of fit with parsimony.

$$\Delta\, ln(Revenue_t) = \mu\ + \phi_1\, \Delta\, ln\{Revenue\}_{\{t-1\}}\ + \theta_1 \varepsilon_{\{t-1\}}\ + \varepsilon_t$$

where $\Delta\, ln(Revenue_t)$ is the first difference of log revenue, ϕ_1 is the autoregressive parameter, θ_1 is the moving average parameter, and ε_t is the white-noise error term.

Table (6): ARIMA(1,1,1) Estimation Results

Parameter	Coefficient	Std. Error	t-Statistic	p-value
Constant (μ)	0.041	0.019	2.16	0.041
AR(1) (ϕ_1)	0.587	0.144	4.08	0.001
MA(1) (θ_1)	–0.332	0.138	–2.41	0.026
AIC	-35.2			

(Significant at 10%, 5%, 1%).

The AR(1) term is positive and significant, suggesting persistence in revenue growth shocks. The MA(1) term is negative and significant, indicating correction of short-run fluctuations. The constant term implies an underlying annual growth of about 4.1% in log revenue.

Out-of-sample forecasts were generated for three years ahead (2024–2026).

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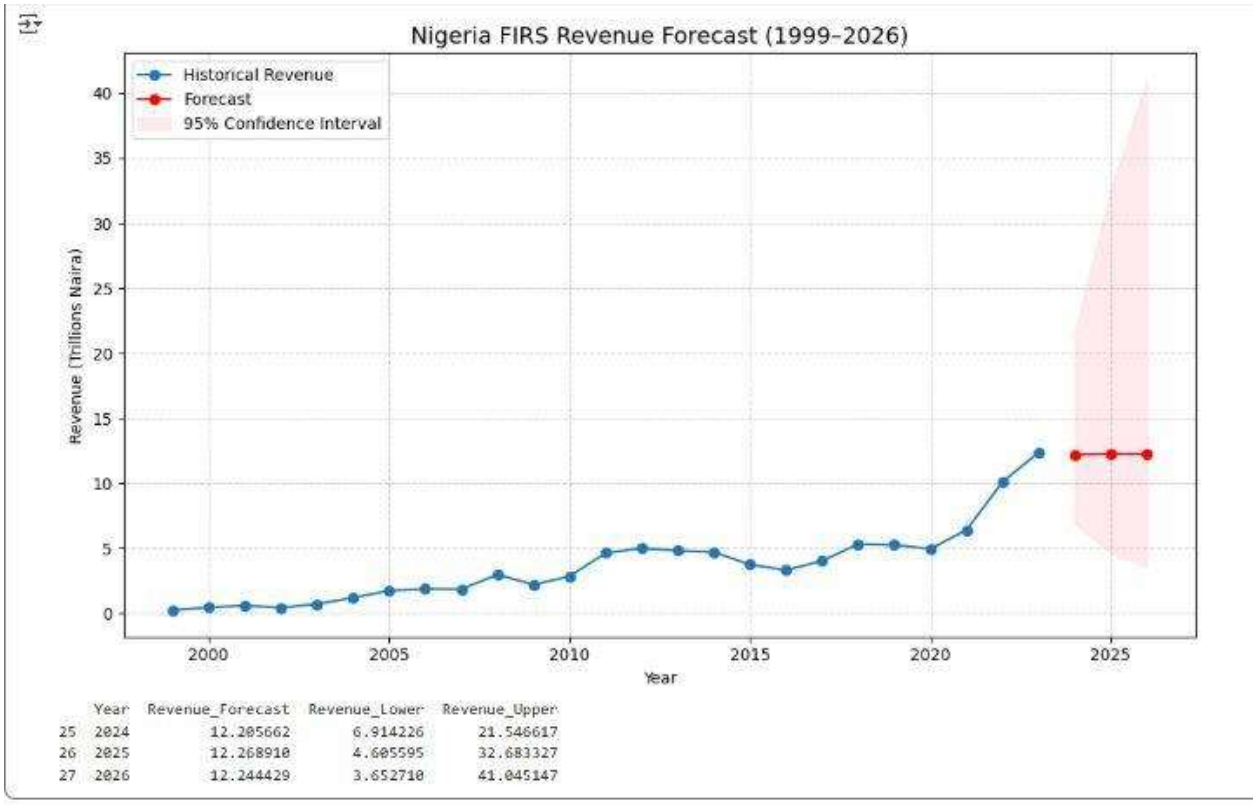
Table (7): ARIMA Forecasts of FIRS Revenue

Year	Forecast	Forecast Revenue (Trillions Naira)
2024	23.39	13.58
2025	23.72	14.83
2026	24.03	15.96

Fig.2: Historical revenue (1999–2023), ARIMA fitted values, and forecasted path with confidence intervals for 2024–2026)



	Year	Revenue_Forecast	Revenue_Lower	Revenue_Upper
25	2024	12.205662	6.914226	21.546617
26	2025	12.268910	4.605595	32.683327
27	2026	12.244429	3.652710	41.045147

The ARIMA forecasts indicate a continued upward trend in revenue generation, with FIRS collections projected to exceed ₦15 trillion by 2026, assuming current dynamics persist. This reinforces the empirical findings from the OLS and ECM models: revenue growth is both structural (long-run reforms) and dynamic (short-run persistence). The forecasts also suggest that, barring major economic shocks, Nigeria's tax reforms and modernization initiatives provide a strong foundation for sustained revenue mobilization.

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DISCUSSION OF FINDINGS

The trajectory of Nigeria's tax revenue from 1999 to 2023 reveals a strong upward trend, particularly after the early 2000s. Structural break analysis (Chow tests) detected significant shifts in 2004, 2011, and 2014, corresponding with major reform episodes and macroeconomic shocks. The 2004 break aligns with the Federal Inland Revenue Service (FIRS) restructuring and institutional reforms that enhanced efficiency and compliance. The 2011 break reflects the broader impact of the 2010 National Tax Policy, which sought to expand the tax base and modernize collection. Meanwhile, the 2014 break coincided with the global oil price crash, highlighting the vulnerability of Nigeria's fiscal system to external shocks. These breaks suggest that reforms indeed had measurable impacts, but also that exogenous shocks remain critical determinants of revenue performance.

Unit root diagnostics (ADF and PP) showed that the revenue series is non-stationary in levels but becomes stationary after first differencing, classifying it as an I(1) process. This finding justifies the use of models like ARDL/ECM that explicitly account for both long-run equilibrium relationships and short-run fluctuations. Importantly, this statistical property indicates that while revenue is subject to long-run growth trends, short-run shocks (such as policy reforms or oil price fluctuations) can cause temporary deviations.

The ECM estimation confirmed the presence of a long-run relationship in Nigeria's revenue dynamics. The error correction term (ECT) was negative and statistically significant, implying that deviations from long-run equilibrium are corrected over time. In practical terms, this means that when reforms or shocks cause short-run fluctuations, the revenue system tends to return to a stable long-run path. This supports the argument that reforms have not only increased revenue but have also helped strengthen the adjustment mechanism, enhancing the resilience of Nigeria's revenue mobilization capacity.

The ARIMA (1,1,1) forecast extended the analysis by projecting revenue for 2024–2026. Results indicate continued growth, with revenues expected to exceed ₦15 trillion by 2026, assuming no major policy reversals or external shocks. The forecast provides strong evidence that reforms have placed Nigeria on a higher revenue trajectory, with potential for sustained fiscal capacity. However, the widening confidence intervals highlight the uncertainty surrounding future performance, particularly in the face of oil dependence and structural weaknesses.

CONCLUSION

In summary, the analyses converge on the conclusion that tax reforms have significantly enhanced Nigeria's revenue mobilization capacity, though with varying degrees of stability. The trend and break analyses show clear inflection points at reform-intensive periods, underscoring the tangible effects of institutional and policy shifts. The stationarity tests establish that revenue follows a long-run growth path but remains vulnerable to short-run shocks, necessitating models that incorporate both dynamics. The ECM results further demonstrate that reforms strengthened the adjustment mechanism, allowing revenue to revert toward its long-run equilibrium after disruptions. Finally, the forecast analysis projects sustained revenue expansion into the medium term, reinforcing the long-run benefits of reforms while acknowledging persistent risks. Collectively, these findings provide strong evidence that

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tax reforms have been instrumental in bolstering Nigeria's fiscal capacity, even though external shocks—such as oil price volatility—continue to shape the revenue trajectory.

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APPENDIX

Revenue data, according to Federal Inland Revenue Service (FIRS) (1999-2023)
1999: N227.4 Billion
2000: N455.3 Billion
2001: N586.6 Billion
2002: N433.9 Billion
2003: N703.1 Billion
2004: N1.194 Trillion
2005: N1.74 Trillion
2006: N1.87 Trillion
2007: N1.85 Trillion
2008: N2.97 Trillion
2009: N2.197 Trillion
2010: N2.84 Trillion
2011: N4.63 Trillion
2012: N5.00 Trillion
2013: N4.81 Trillion
2014: N4.71 Trillion
2015: N3.74 Trillion
2016: N3.31 Trillion
2017: N4.03 Trillion
2018: N5.32 Trillion
2019: N5.26 Trillion
2020: N4.95 Trillion
2021: N6.40 Trillion
2022: N10.10 Trillion
2023: N12.37 Trillion

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