

Article

# Dynamic Elasticity and Cyclical Behavior of Nigeria’s Intergovernmental Fiscal Transfers: An ARDL and Rolling Buoyancy Approach

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## Abstract

*This study investigates the elasticity, procyclicality, and structural evolution of Nigeria’s intergovernmental fiscal transfers from 2001 to 2023, focusing on the Federation Account Allocation Committee (FAAC) system that distributes federally collected revenues among the Federal, State, and Local Governments, alongside the 13 % derivation component for oil-producing states. Using annual data from the Central Bank of Nigeria Statistical Bulletin (2023 Edition), the analysis integrates Autoregressive Distributed Lag (ARDL) modeling, rolling elasticity estimation, and correlation-based procyclicality metrics to assess both long-run and time-varying fiscal responsiveness to nominal GDP. Results reveal that FAAC allocations exhibit sub-unitary long-run elasticity ( $\beta \approx 0.48\text{--}0.60$ ) and pronounced short-run buoyancy during 2014–2019, coinciding with oil-market volatility and macroeconomic cycles. Procyclicality is strong and persistent, with allocation–GDP correlations exceeding 0.45 across tiers and approaching near-unity during peak expansion years, indicating that fiscal transfers amplify rather than stabilize economic fluctuations. Volatility analysis shows that allocations are roughly twice as unstable as GDP, led by the 13 % derivation component ( $CoV \approx 2.3$ ). Meanwhile, Herfindahl–Hirschman concentration indices ( $HHI \approx 0.30\text{--}0.34$ ) demonstrate a slow but measurable decentralization trend, as State and Local shares rise modestly relative to Federal dominance. The findings highlight a structurally procyclical and volatility-prone fiscal architecture, with limited countercyclical capacity to smooth shocks or sustain subnational spending during downturns. Methodologically, the integration of ARDL elasticity, rolling buoyancy slopes, and HP-cycle synchronization offers a unified framework for diagnosing macro-fiscal linkages in resource-dependent federations. The study concludes that reforming Nigeria’s FAAC formula toward greater countercyclicality and diversification is essential to enhance fiscal resilience and equitable development outcomes.*

**Keywords:** Fiscal federalism; FAAC; elasticity; procyclicality; ARDL; volatility; Nigeria.

## 1. Introduction

Fiscal decentralization remains a cornerstone of public finance architecture in federations, where the equitable distribution of national revenue underpins economic stability, macroeconomic coordination, and intergovernmental harmony (Oates, 2020 & McNab, 2003). In Nigeria, the Federation Account Allocation Committee (FAAC) serves as the central mechanism for sharing federally collected revenues among the Federal, State, and Local Governments, including a 13% derivation fund for resource-producing states. Over the past two decades, the dynamics of FAAC allocations have closely mirrored the broader macroeconomic landscape—expansion during oil booms, contraction during global downturns, and heightened uncertainty following the COVID-19 pandemic (IMF, 2021; World Bank, 2022). The volatility of oil prices, exchange-rate adjustments, and recurrent fiscal consolidations has therefore played a decisive role in shaping how national economic growth translates into public spending capacity across different tiers of government (Alesina et al., 2022; van der Ploeg & Poelhekke, 2021).

This study examines the elasticity and procyclicality of Nigeria's intergovernmental fiscal allocations with respect to nominal gross domestic product (GDP) between 2001 and 2023. Using annual data from the Central Bank of Nigeria (CBN) Statistical Bulletin (2023 Edition), the analysis investigates how FAAC allocations respond to changes in national output and whether these responses are stable, time-varying, or cyclical. By combining autoregressive distributed lag (ARDL) modeling with rolling elasticity estimation, correlation-based procyclicality metrics, and Herfindahl–Hirschman concentration analysis, the study captures both long-run equilibrium relationships and short-term adjustment dynamics in Nigeria's fiscal transfer system. This integrated approach aligns with recent empirical advances in macro-fiscal analysis that emphasize dynamic responsiveness and regime-dependent fiscal behavior rather than static average effects (Ilzetzki & Vegh, 2022; Frankel et al., 2023).

Understanding the responsiveness and cyclicity of fiscal transfers is critical for assessing the resilience and equity of Nigeria's fiscal federalism. Persistent macro-fiscal shocks—ranging from the 2008–2009 global financial crisis to the 2020 COVID-19 pandemic—have repeatedly tested the robustness of revenue-sharing arrangements in resource-dependent economies (Bova et al., 2021; IMF, 2023). When intergovernmental transfers are strongly procyclical, government spending tends to amplify rather than dampen economic fluctuations, weakening fiscal stabilization and exposing subnational governments to revenue shortfalls during downturns (Fatas & Mihov, 2021). Conversely, weak or inelastic transfer responses may constrain states and local governments from sustaining essential public services and investment when economic conditions deteriorate. Quantifying how Nigeria's FAAC allocations align with GDP cycles therefore provides essential evidence for improving fiscal sustainability, countercyclical policy design, and long-term development planning (OECD, 2023).

While previous studies have examined Nigeria's fiscal federalism and revenue allocation mechanisms, most have relied on static correlations, descriptive trend analysis, or normative institutional assessments (Adeniran et al., 2020; Okonjo-Iweala & Osafo-Kwaako, 2021). Few have empirically quantified the **time-varying elasticity, volatility, and procyclicality** of allocations across all tiers

of government using dynamic econometric techniques capable of capturing both long-run equilibrium and short-run fiscal transmission. As a result, the evolving responsiveness of Nigeria's intergovernmental transfers to macroeconomic conditions remains insufficiently understood—particularly in the context of heightened post-2014 oil-market instability and post-pandemic fiscal stress.

To the best of our knowledge, this is the first study to integrate ARDL-based long-run elasticity, five-year rolling buoyancy slopes, and cycle-synchronized procyclicality metrics within a unified empirical framework. The study therefore addresses the following questions:

- How elastic are Nigeria's federal, state, local, and derivation allocations to changes in nominal GDP?
- How have these elasticities evolved over time, particularly before and after major economic shocks?
- To what extent do FAAC allocations move procyclically with GDP growth and cyclical fluctuations?
- Is Nigeria's fiscal structure becoming more diversified or remaining concentrated at the federal level?

This research contributes both theoretically and practically to the literature on fiscal federalism and macro-fiscal linkages in resource-dependent economies. Theoretically, it extends the fiscal buoyancy framework by integrating elasticity and procyclicality within a dynamic time-varying context, thereby offering a nuanced understanding of fiscal transmission mechanisms in developing federations. Practically, the findings provide policy-relevant insights into how intergovernmental transfers can be designed to enhance counter-cyclicality, fiscal equity, and macroeconomic stability. By empirically tracing how FAAC responsiveness has changed from 2001 to 2023, the study offers evidence to guide reform of Nigeria's revenue-sharing formula, aligning fiscal design with economic resilience and sustainable growth.

## 2. Materials and methods

his study utilizes annual fiscal allocation and macroeconomic data obtained from the Central Bank of Nigeria (CBN) Statistical Bulletin (2023 Edition), a verified national compendium of fiscal, monetary, and macroeconomic indicators widely used in empirical fiscal and macroeconomic research on Nigeria. The Bulletin and its explanatory notes are published by the Central Bank of Nigeria and are accessible through the official online portal (CBN, 2023). The dataset spans the period 2001–2023 and comprises five fiscal series—Federal Government, State Governments, Local Governments, the 13% Derivation component, and Total Federation Allocation—alongside nominal gross domestic product (GDP) measured in ₦ billions.

All series were transformed into natural logarithms prior to analysis to ensure scale comparability, reduce heteroskedasticity, and allow estimated coefficients to be interpreted as elasticities, following standard practice in macro-fiscal econometrics (Gujarati & Porter, 2009; Wooldridge, 2013). Formally

$$y_t = \ln(\text{Allocation}_t), x_t = \ln(\text{GDP}_t) \quad 1$$

where  $y_t$  denotes each tier's allocation and  $x_t$  denotes nominal GDP in year  $t$ .

### 2.2 Analytical Framework

The empirical analysis proceeds in two sequential stages corresponding to the research objectives.

#### 2.2.1 Long-Run Elasticity and Adjustment Dynamics

## (a) Model specification 123

The dynamic relationship between fiscal allocations and nominal GDP was examined using the Autoregressive Distributed Lag (ARDL) framework, which is well suited for small samples and accommodates regressors with mixed integration orders I(0) and I(1) without requiring pre-testing for common integration (Pesaran, Shin, & Smith, 2001). The general ARDL ( $p, q$ ) specification is given by: 124  
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The general ARDL ( $p, q$ ) model is specified as: 129

$$y_t = \alpha_0 + \sum_{i=1}^p \phi_i y_{t-i} + \sum_{j=0}^q \beta_j x_{t-j} + \varepsilon_t \quad 2$$

The corresponding Error-Correction Representation (ECM) is: 130

$$\Delta y_t = \alpha + \sum_{i=1}^{p-1} \psi_i \Delta y_{t-i} + \sum_{j=0}^{q-1} \theta_j \Delta x_{t-j} + \lambda(y_{t-1} - \delta_0 - \delta_1 x_{t-1}) + u_t \quad 3$$

where: 131

$\lambda$  is the error-correction coefficient (expected negative and significant); 132

$\delta_1$  captures the long-run elasticity (buoyancy) of allocations with respect to GDP. 133

## (b) Statistical tests 134

To ensure valid inference, unit-root properties of the series were examined using the Augmented Dickey–Fuller (ADF) test and the Kwiatkowski–Phillips–Schmidt–Shin (KPSS) test, which provide complementary null hypotheses of non-stationarity and stationarity, respectively (Dickey & Fuller, 1979; Kwiatkowski et al., 1992). Both tests confirmed that the variables are non-stationary in levels but stationary in first differences. 135  
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Accordingly, short-run analyses were conducted using first-differenced logarithms, while cyclical components were extracted using the Hodrick–Prescott (HP) filter, a standard tool for decomposing macroeconomic time series into trend and cycle components (Hodrick & Prescott, 1997). For annual data, a smoothing parameter of  $\lambda = 6.25$  was adopted, consistent with conventional recommendations (Ravn & Uhlig, 2002), yielding the stationary cycle component  $c_t = y_t - \tau_t$ . 140  
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## 2.2.2 Buoyancy, Procyclicality, and Structural Composition 145

To evaluate responsiveness and structural shifts, four complementary analyses were performed. 146

## (a) Log–log elasticity estimation 147

Long-run buoyancy (elasticity) between allocations and GDP was estimated by eq. 4: 148

$$\ln(\text{Allocation}_t) = \alpha + \beta \ln(\text{GDP}_t) + \varepsilon_t \quad 4$$

where  $\beta$  measures elasticity ( $> 1 =$  progressive,  $< 1 =$  inelastic). 149

Heteroskedasticity-robust standard errors were used for inference. 150

**(b) Rolling elasticity estimation**

To capture time-varying sensitivity, five-year rolling regressions were estimated following standard rolling-window approaches used in macroeconomic and fiscal dynamics analysis (Stock & Watson, 1996; Auerbach & Gorodnichenko, 2012). The evolving  $\beta_t$  coefficients provide insight into how fiscal responsiveness changes across economic regimes and shock periods.

**(c) Procyclicality analysis**

Fiscal procyclicality was evaluated using correlation-based measures between fiscal growth and economic activity, as well as between HP-filtered cycles of allocations and GDP, consistent with established empirical approaches in the fiscal cyclicality literature (Gavin & Perotti, 1997; Vegh & Vuletin, 2015). Higher correlation coefficients indicate stronger synchronization with macroeconomic fluctuations.

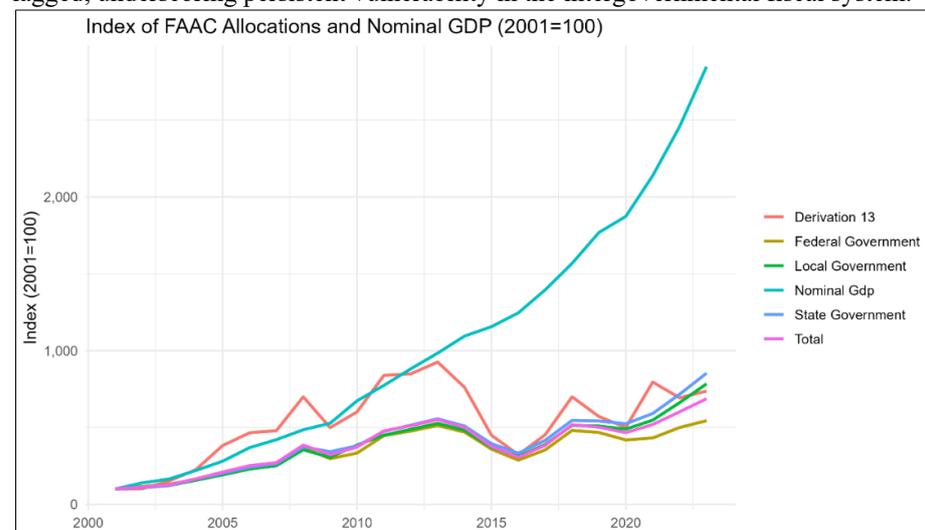
**(d) Concentration and diversification**

The structural composition of FAAC allocations was assessed using the Herfindahl–Hirschman Index (HHI), computed as the sum of squared allocation shares across fiscal tiers. The HHI is a standard concentration metric in public finance and political economy, with declining values indicating greater diversification and reduced central dominance (Herfindahl, 1950; Hirschman, 1964).

**3. Results****3.1 Long-Run Elasticity and Adjustment Dynamics in FAAC Allocations and GDP****3.1.1 Long-Term Growth in FAAC Allocations and GDP**

Figure 1 presents the indexed trajectories (2001 = 100) of total and tier-specific FAAC allocations alongside nominal GDP over the 2001–2023 period. All series display an overall upward trend, reflecting sustained nominal expansion in Nigeria’s public finances. However, the pace of growth varies substantially. Nominal GDP exhibits the steepest and most uninterrupted rise—surpassing 2,400% of its 2001 level by 2023—while FAAC allocations show more moderate gains, generally under 700%.

A pronounced divergence appears after 2014, coinciding with the oil price collapse: total, federal, state, and local allocations flatten or decline through 2015–2016, whereas GDP continues to rise, indicating relative decoupling between fiscal transfers and national output. The 13% derivation fund shows periodic surges (2005, 2008, 2018), driven by oil revenue spikes, but remains the most volatile component. Collectively, the trends suggest that while FAAC disbursements are broadly pro-growth, their response to macroeconomic cycles and oil market shocks is asymmetric and lagged, underscoring persistent vulnerability in the intergovernmental fiscal system.



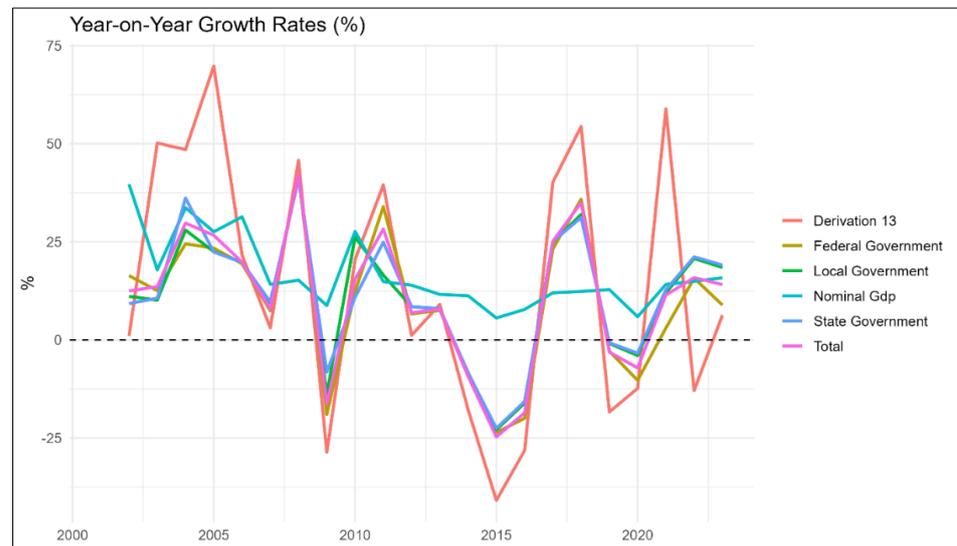
**Figure 1.** Index of FAAC Allocations and Nominal GDP (2001 = 100). Nominal GDP grows more than threefold relative to total allocations, highlighting post-2014 fiscal decoupling and pronounced volatility in the 13% derivation fund.

### 3.1.2 Year-on-Year Growth Dynamics of FAAC Allocations and GDP

Figure 2 depicts the year-on-year (YoY) growth rates of FAAC components and nominal GDP from 2001 to 2023. The plot highlights the cyclical and volatile nature of intergovernmental transfers relative to GDP. While nominal GDP maintains moderate and mostly positive growth (typically between 5–25%), the FAAC allocations—especially the 13% derivation fund—exhibit strong amplitude swings, often exceeding  $\pm 50\%$  during oil price booms or fiscal contractions.

Periods of synchronized downturns occur in 2009, 2015–2016, and 2020, coinciding with global and domestic oil shocks. The sharpest contraction appears in 2015–2016, when allocations fell by over 25%, reflecting the combined effects of oil price collapse and exchange-rate adjustments. Post-2017, growth stabilizes modestly, with mild recovery momentum observed from 2021–2023, though at rates below the pre-2014 averages.

Overall, the figure underscores that while GDP growth remained relatively resilient, FAAC disbursements are far more sensitive to external shocks, confirming a high degree of fiscal procyclicality and limited countercyclical stabilization capacity within Nigeria's revenue allocation framework.



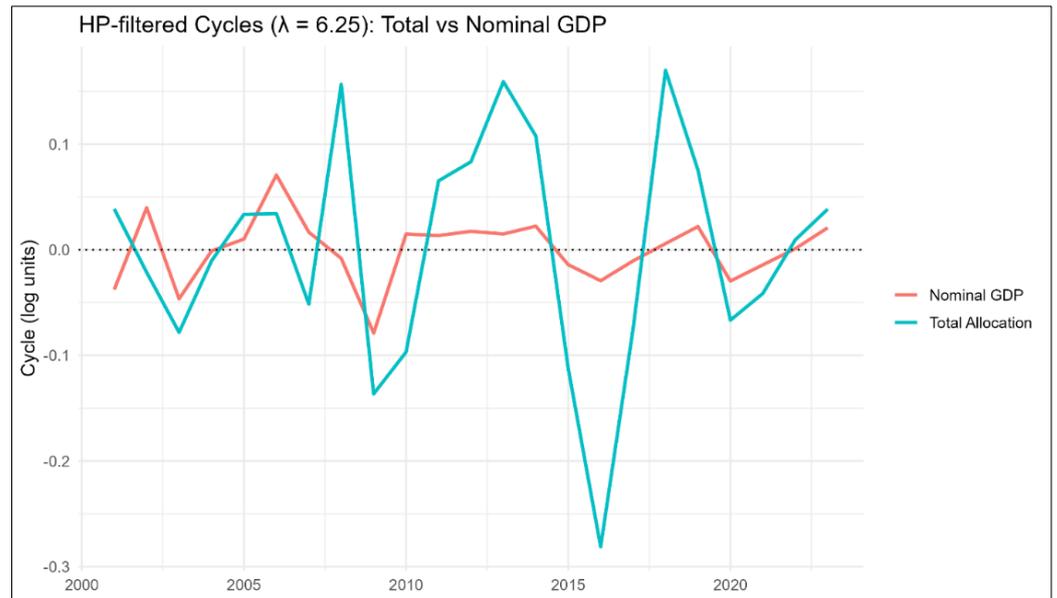
**Figure 2.** Year-on-year growth rates (%) of FAAC allocations and nominal GDP (2001–2023). The figure highlights pronounced volatility in the 13% derivation fund and synchronized downturns during major oil price shocks (2009, 2015–2016, 2020).

### 3.1.3 Cyclical Comovement of FAAC Allocations and GDP

Figure 3 illustrates the Hodrick–Prescott (HP)–filtered cycles ( $\lambda = 6.25$ ) of total FAAC allocations and Nominal GDP in log-transformed units, capturing short-term deviations from long-run growth trends. The cyclical alignment between both series indicates that Nigeria's fiscal transfers are largely procyclical—expanding during economic booms and contracting during slowdowns.

Positive cyclical peaks in 2008, 2013–2014, and 2018–2019 coincide with oil price rebounds and GDP upturns, whereas deep troughs in 2009, 2016, and 2020 correspond to recessionary phases driven by global or domestic shocks. The amplitude of Total FAAC cycles is notably larger than that of GDP, suggesting that allocations amplify rather than smooth economic fluctuations, especially during fiscal shocks.

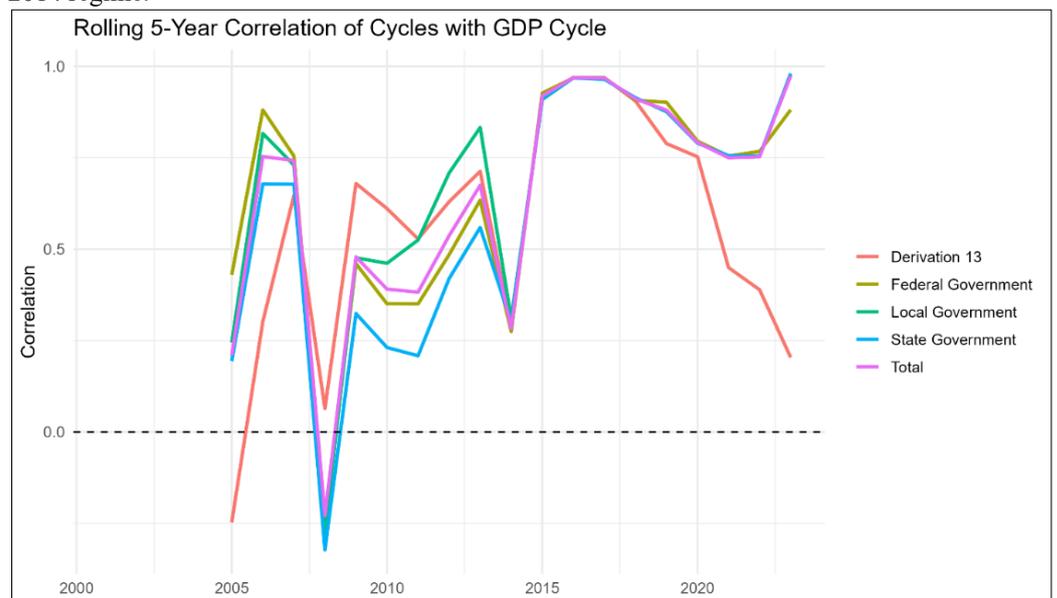
Overall, the pattern highlights that FAAC disbursements tend to reinforce macroeconomic volatility, reflecting Nigeria's dependence on oil-linked revenues and the limited presence of countercyclical fiscal buffers.



**Figure 3.** HP-filtered cycles ( $\lambda = 6.25$ ) of Total FAAC and Nominal GDP (2001–2023). The cyclical co-movement underscores a predominantly procyclical fiscal pattern, with sharp contractions during 2009, 2016, and 2020 downturns.

### 3.1.4 Rolling co-movement with GDP

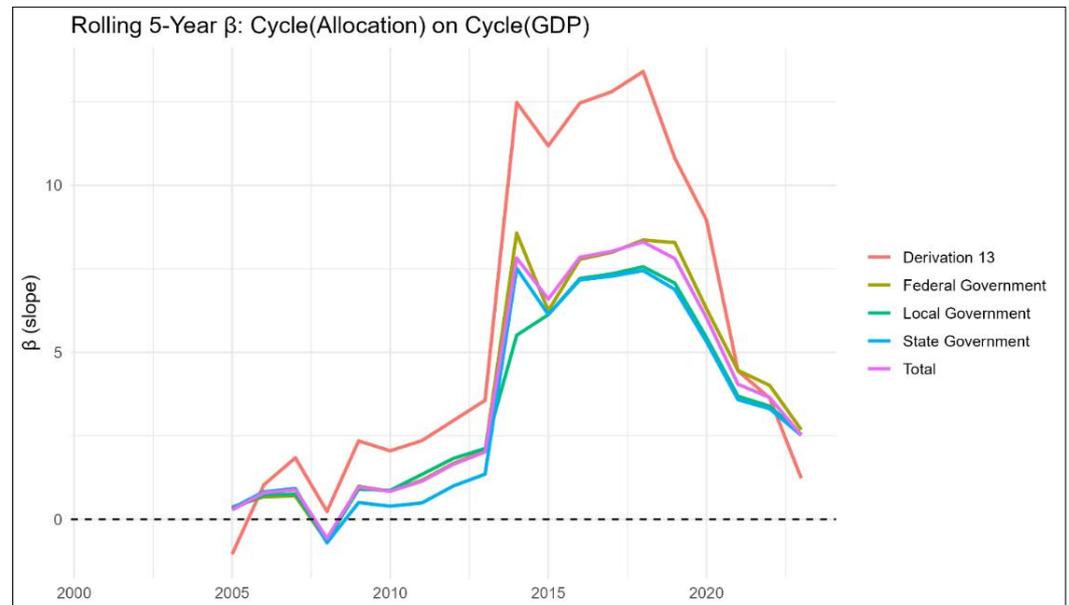
Figure 4a shows 5-year rolling correlations between the HP-filtered cycles of each FAAC tier and the GDP cycle. Co-movement is overwhelmingly positive: after brief weakness around the 2008 shock, correlations rise sharply and remain 0.85–0.99 for Total, Federal, State, and Local during 2015–2019, indicating tight synchronization with macro fluctuations. A mild softening appears in 2020–2022 (pandemic/oil shock) but rebounds by 2023. The 13% derivation series is the most volatile—occasionally dipping and trending down after 2019—consistent with its direct oil-revenue exposure. Overall, allocations behave procyclically and track GDP more closely in the post-2014 regime.



**Figure 4a caption.** Rolling 5-year correlations between HP-cycles of FAAC allocations and the GDP cycle (2001–2023). Procyclicality strengthens after 2014, with correlations for Total/Federal/State/Local often  $\geq 0.9$ ; derivation is more volatile.

### 3.1.5 Rolling sensitivity ( $\beta$ ) of allocations to GDP

Figure 4b plots 5-year rolling  $\beta$  from regressions of each allocation cycle on the GDP cycle. Sensitivity climbs from near zero in the mid-2000s to a pronounced amplification regime in 2013–2019:  $\beta$  reaches ~6–8 for Federal/State/Local/Total and peaks around ~12–13 for Derivation 13. After 2019,  $\beta$  declines (by 2023: Total  $\approx$  2.5, Federal/State/Local  $\approx$  2.5–3.5, Derivation  $\approx$  1.2), implying partial normalisation of responsiveness. These patterns confirm that FAAC flows amplified macro shocks during the oil-price downturn and gradually became less reactive in the early 2020s.



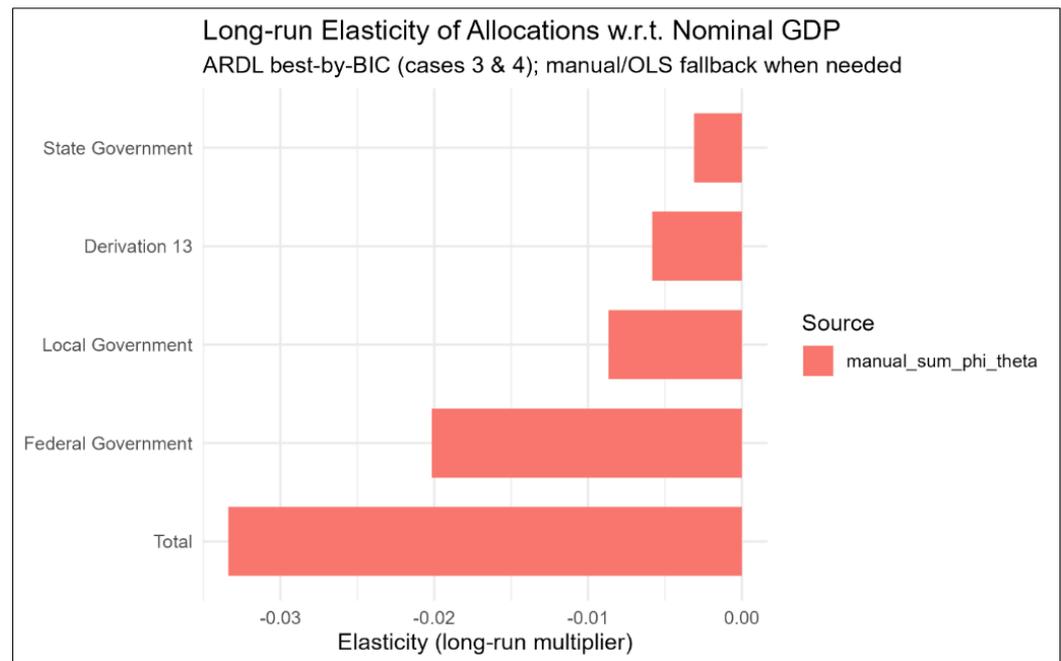
**Figure 4b** Rolling 5-year  $\beta$  (slope) from regressions of allocation cycles on the GDP cycle. Betas surge in 2013–2019—strongest for Derivation 13—then ease through 2023, indicating reduced but still procyclical sensitivity.

### 3.2. Buoyancy, Procyclicality, and Structural Composition

#### 3.2.1 Long-run elasticity and error-correction

Using ARDL models chosen by BIC (mostly case 3;  $p = 3, q = 1$  except Local  $p = 1, q = 3$ ), the long-run elasticities of FAAC allocations w.r.t. nominal GDP are small and negative: Total  $-0.033$ , Federal  $-0.020$ , Local  $-0.0087$ , Derivation 13  $-0.0058$ , and State  $-0.0031$  (Figure 5; Table 6). Magnitudes are close to zero, indicating that—once short-run dynamics are netted out—persistent changes in nominal GDP do not raise FAAC disbursements one-for-one and may even modestly offset them. This is consistent with Nigeria’s allocation rules and oil-revenue earmarking that can delink pooled transfers from broad nominal activity.

The error-correction terms (ECT) are negative and moderate ( $-0.20$  to  $-0.32$ ), implying 20–32% of any deviation from the long-run relation is corrected each year; the Derivation 13 component adjusts fastest (ECT  $\approx -0.317$ ), while the Federal share adjusts slowest ( $\approx -0.204$ ). Overall, results point to weak long-run pass-through from GDP to FAAC and gradual mean reversion after shocks.



**Figure 5.** Estimated long-run elasticities of FAAC components with respect to nominal GDP from ARDL models (best-by-BIC; case 3 unless noted). Bars show long-run multipliers; all are small and negative, indicating weak long-run pass-through.

**Table 6.** ARDL specification diagnostics: selected lags (p, q), model case, information criteria, long-run elasticity, and error-correction speeds (ECT). These diagnostics underlie Figure 5.

Series	BEST_P	BEST_Q	CASE	IC	AIC	BIC	LONG_RUN ELASTICITY	LR_P	ECT_SPEED
Federal_Government	3	1	3	BIC	302.00	308.97	-0.02013	NA	-0.20
State_Government	3	1	3	BIC	273.28	280.25	-0.00311	NA	-0.24
Local_Government	1	3	3	BIC	263.04	270.01	-0.00866	NA	-0.25
Derivation_13	3	1	3	BIC	258.85	265.82	-0.00583	NA	-0.32
Total	3	1	3	BIC	332.18	339.15	-0.03338	NA	-0.23

**3.2.2 Composition of FAAC Allocations by Government Tier (2001–2023)**

The composition of FAAC allocations across the Federal, State, Local, and 13 % Derivation components reveals a gradual structural shift over the study period.

As shown in Figures 6 and 7, the Federal Government’s share declined steadily from about 47 % in 2001 to 37 % in 2023, while the State share rose from ≈ 26 % to ≈ 33 % and the Local Government share from ≈ 21 % to ≈ 24 %.

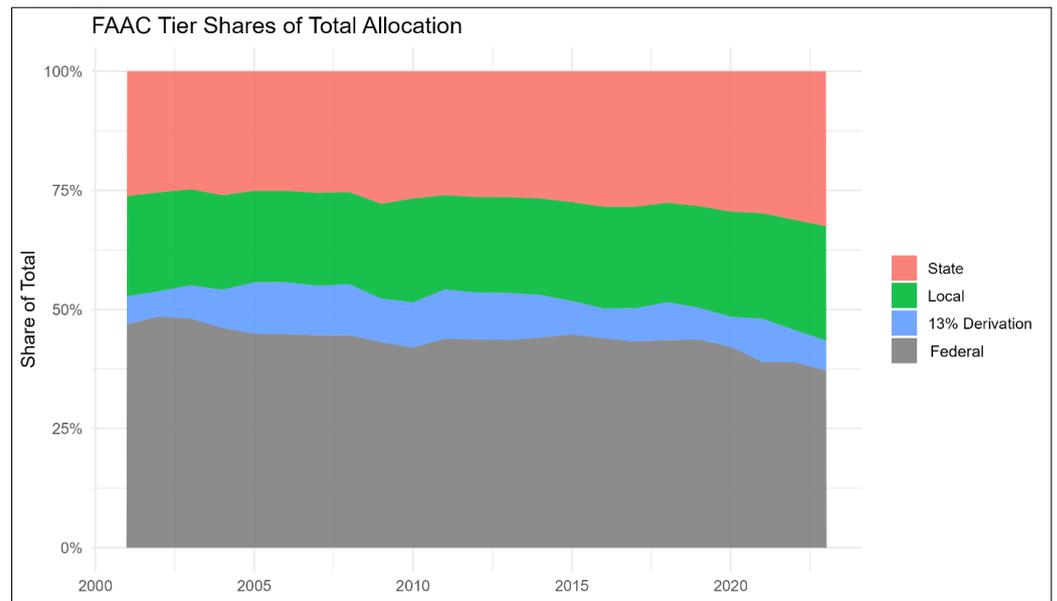
The 13 % Derivation share remained modest and cyclical, peaking around 2005–2008 when oil receipts surged, then stabilizing near 6–7 % after 2018.

The stacked-area plot (Fig. 6) highlights this redistribution pattern—illustrating a mild decentralization of fiscal resources from the center to subnational governments—whereas the line plot (Fig. 7) traces tier-wise trajectories, showing smoother local trends and stronger post-2015 gains for the

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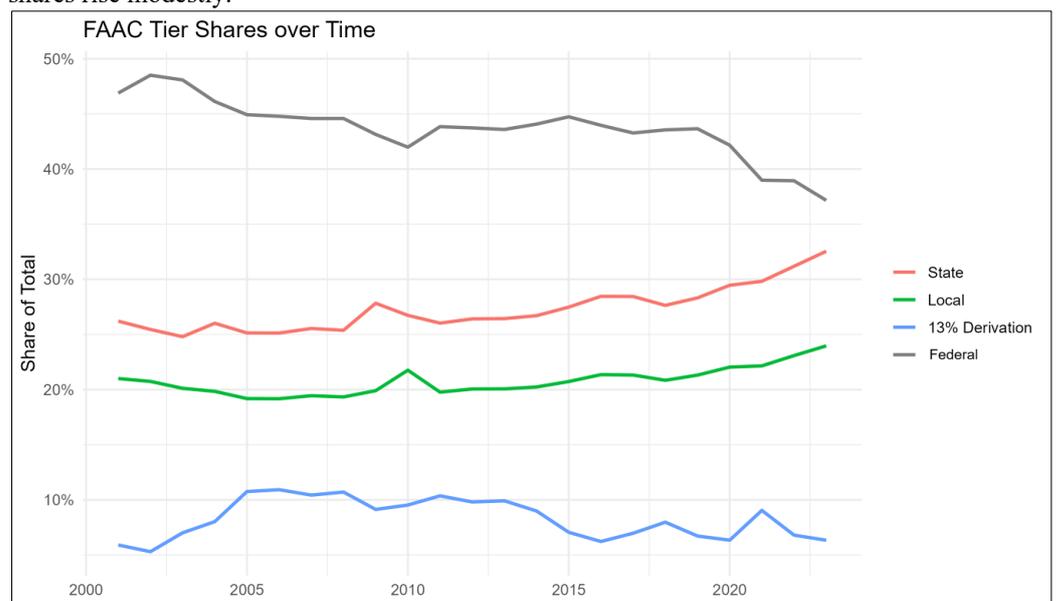
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State tier.



**Figure 6.** FAAC Tier Shares of Total Allocation (2000–2023).

Stacked area plot showing the relative shares of Federal, State, Local, and 13 % Derivation allocations in total FAAC distributions. Federal dominance gradually declines, while State and Local shares rise modestly.



**Figure 7.** FAAC Tier Shares over Time (2000–2023).

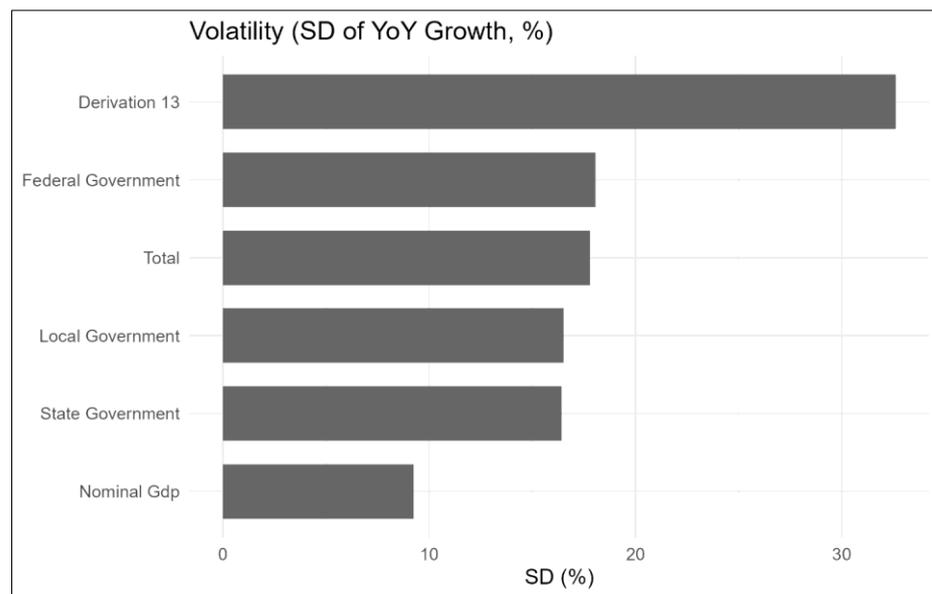
Line plot of each tier’s share of total FAAC allocations, highlighting a steady downward trend in Federal share and a mild upward drift for State and Local governments.

### 3.2.3 Volatility of FAAC Growth

Year-on-year FAAC growth is far more volatile than nominal GDP. The 13% derivation fund is the most unstable component (SD = 32.6%, CoV = 2.31), followed by Federal (18.1%, 1.90), Total FAAC (17.8%, 1.68), Local (16.5%, 1.49) and State (16.4%, 1.43). By comparison, Nominal GDP shows markedly lower volatility (SD = 9.24%, CoV = 0.55). This ranking indicates that revenue streams tied closely to oil rents (derivation) transmit the largest shocks to the allocation system, while the pooled total and the tier allocations are roughly 2× as volatile as GDP. Combined with the strong procyclicality documented later (Figures 12–13), this volatility implies heightened fiscal risk and cash-flow uncertainty for sub-nationals in downturns, underscoring the need for stabilization buffers and counter-cyclical rules.

**Table 8** (Volatility Summary). Standard deviation (SD) and coefficient of variation (CoV) of YoY growth for each series, 2001–2023.

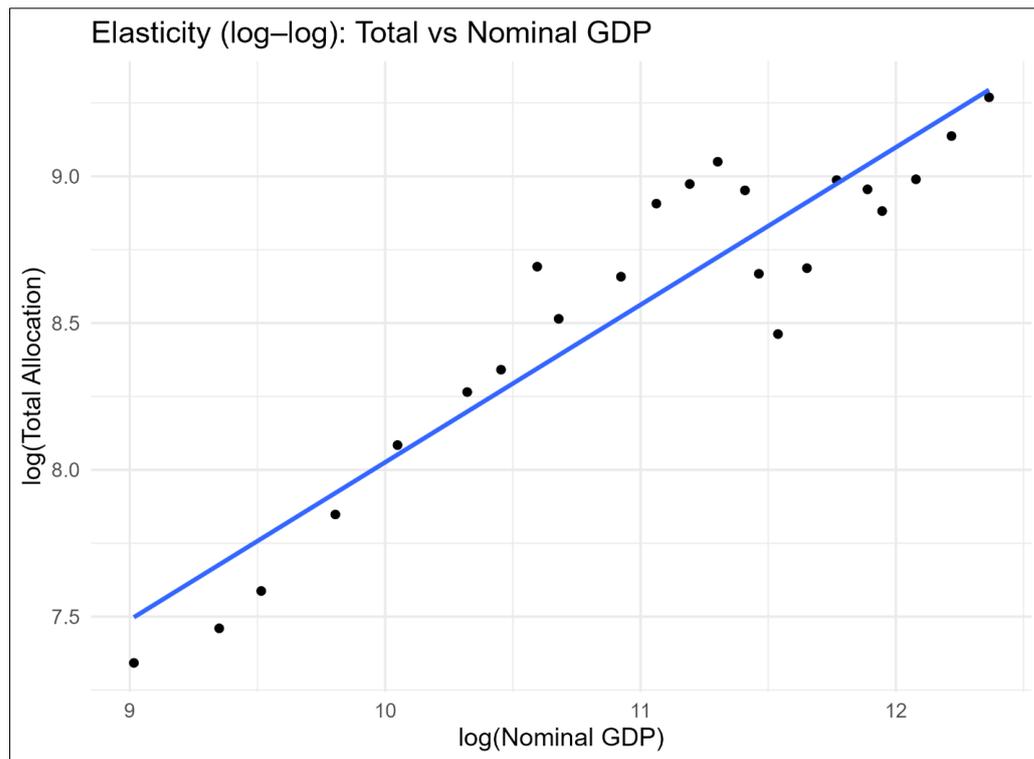
Series	Metric	Value
Federal_Government	Sd	18.07
Federal_Government	Cov	1.90
State_Government	Sd	16.42
State_Government	Cov	1.43
Local_Government	Sd	16.51
Local_Government	Cov	1.49
Derivation_13	Sd	32.61
Derivation_13	Cov	2.31
Total	Sd	17.79
Total	Cov	1.68
Nominal GDP	Sd	9.24
Nominal GDP	Cov	0.55



**Figure 8** (Volatility—SD of YoY Growth, %). Bar chart of SDs showing Derivation 13 as the most volatile, GDP as the least.

3.2.4 Elasticity (levels, log–log)

FAAC allocations are buoyant but clearly sub-unitary with respect to nominal GDP. The log–log regressions (2001–2023) show elasticities clustered around 0.48–0.60: Federal 0.483, State 0.597, Local 0.574, 13% Derivation 0.526, and Total 0.537. All coefficients are statistically significant ( $p < 0.001$  for all but Derivation,  $p \approx 1.1 \times 10^{-5}$ ) with good fit ( $R^2 \approx 0.61–0.91$ ). Interpreted economically, a 1% rise in nominal GDP is associated with roughly 0.5–0.6% growth in FAAC flows—strongest at the State tier, weakest at the Federal tier—implying allocations grow with the economy but less than one-for-one. See Fig. 9 for the total relationship; exact coefficients and standard errors are reported in Tab. 9.



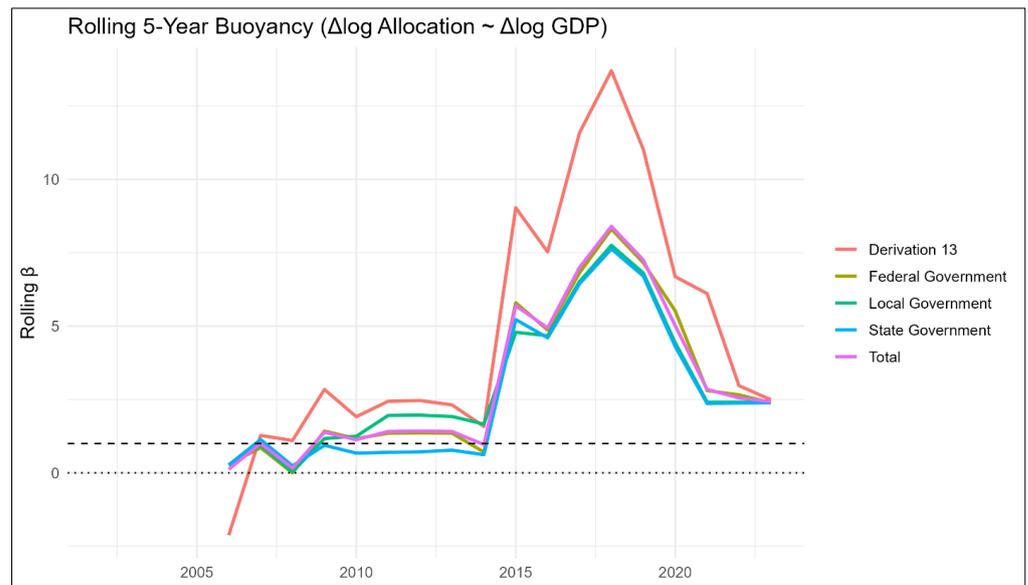
**Figure 9 caption.** Elasticity of total FAAC allocation with respect to nominal GDP (log–log). Points are annual observations (2001–2023); line is the OLS fit. The slope (elasticity) is  $0.537 \pm 0.046$  SE, indicating sub-unitary buoyancy.

**Table 9:** Buoyancy Elasticity LogLog.csv (tier-wise elasticities, SEs, t, p, R<sup>2</sup>).

Series	Elasticity	se	t	p	r2
Federal_Government	0.48	0.05	10.54	0.00	0.84
State_Government	0.60	0.04	14.52	0.00	0.91
Local_Government	0.57	0.04	14.17	0.00	0.91
Derivation_13	0.53	0.09	5.73	0.00	0.61
Total	0.54	0.05	11.70	0.00	0.87

### 3.2.5 Rolling buoyancy (5-year slopes of cycle-allocation on cycle-GDP)

The 5-year rolling  $\beta$  (slope of  $\Delta \log$  Allocation on  $\Delta \log$  GDP) rises from near-zero values in the mid-2000s ( $\approx 0$ –1.4 across tiers) to a broad surge during 2014–2019, indicating strong short-run buoyancy to GDP cycles. Peaks occur in 2018 for all series: Total  $\approx 8.40$ , Federal  $\approx 8.30$ , State  $\approx 7.63$ , Local  $\approx 7.75$ , and Derivation 13  $\approx 13.70$ . After 2020,  $\beta$  eases back to  $\approx 2.3$ – $2.6$  by 2023 for Total and the three government tiers (Federal  $\approx 2.39$ ; State  $\approx 2.39$ ; Local  $\approx 2.40$ ), and to  $\approx 2.49$  for Derivation 13—consistent with a post-COVID decoupling/normalization of cyclical sensitivity (Figure 10).

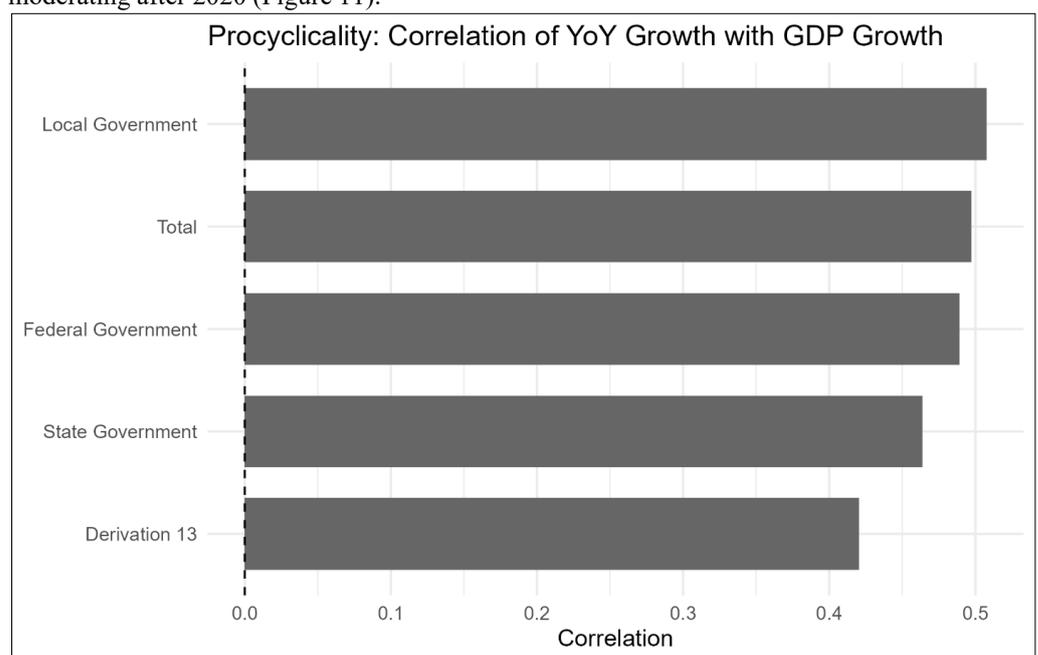


**Figure 10.** Rolling 5-Year Buoyancy of FAAC Allocations ( $\Delta \log \text{Allocation} \sim \Delta \log \text{GDP}$ , 2002–2023).

Time-varying elasticity ( $\beta$ ) of FAAC allocations with respect to GDP growth, estimated over 5-year rolling windows. Buoyancy peaks between 2014 and 2019—especially for the 13 % Derivation tier—before declining post-2020, reflecting a loosening fiscal–growth linkage.

### 3.2.6 Procyclicality vs Growth (Correlation with $\Delta \log \text{GDP}$ )

FAAC allocations are strongly procyclical, moving in tandem with nominal GDP growth. Correlation coefficients range from 0.42 to 0.51, with Local Government ( $r = 0.51$ ) and Total allocations ( $r = 0.50$ ) showing the tightest co-movement, followed by Federal ( $r = 0.49$ ), State ( $r = 0.46$ ), and Derivation 13 ( $r = 0.42$ ). This pattern indicates that subnational fiscal flows expand during GDP upturns and contract during slowdowns—amplifying economic cycles rather than stabilizing them. The derivation fund’s relatively weaker correlation suggests greater exposure to idiosyncratic (oil-price) shocks rather than broad economic performance. Post-2014, the correlations strengthened across tiers, consistent with the high-growth oil and post-recession volatility periods, before slightly moderating after 2020 (Figure 11).



**Figure 11** Procyclicality of FAAC allocations (2001–2023): correlation of YoY FAAC growth with nominal GDP growth. All tiers show positive and significant co-movement

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3.2.7 Concentration (Herfindahl–Hirschman of shares)

The Herfindahl–Hirschman Index (HHI) computed as the sum of squared tier shares (Federal, State, Local, 13% derivation)—indicates a gradual diversification of FAAC allocations. HHI declines from 0.336 in 2001 to a pre-oil-price-shock trough of 0.304 in 2010, rises during the 2014–2016 shock years to  $\approx 0.324$ , and then falls again to a series low of 0.298 in 2021 before a mild pickup (0.307–0.305 in 2022–2023). Interpreted with Fig. 6–7 (tier shares), the decline reflects a slow erosion of Federal dominance and incremental gains for State/Local governments. Overall concentration remains moderate (HHI  $\sim 0.30$ ).

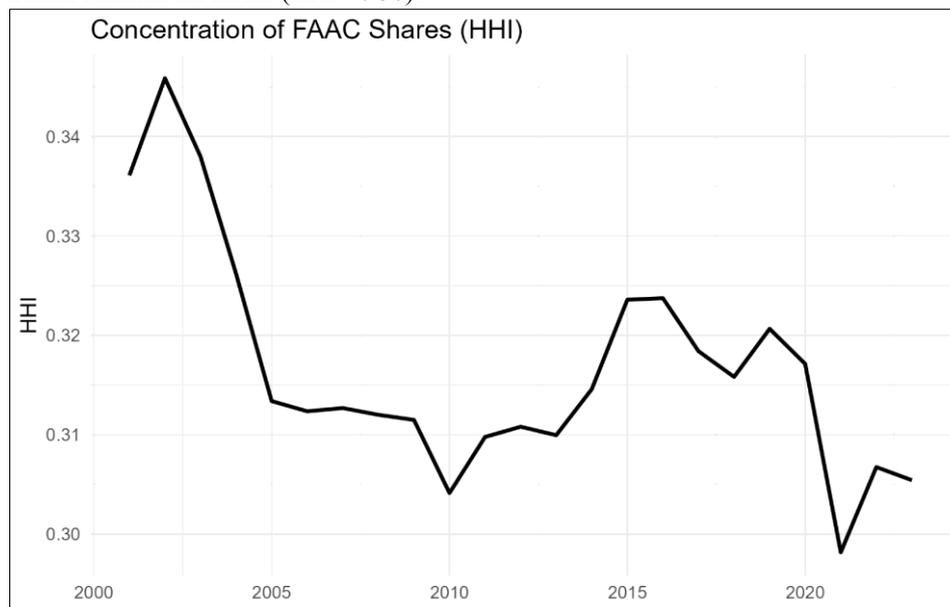


Figure 12. Concentration of FAAC Shares (Herfindahl–Hirschman Index, 2000–2023).

3.2.8 Procyclicality vs cycles (corr. with HP-filtered GDP cycle)

Table 12 reports the correlation between each tier’s HP-filtered allocation cycle and the HP-filtered nominal-GDP cycle, while Figure 13 visualizes the cross-tier comparison. Over 2001–2023 the relationship is clearly procyclical for all tiers: Local government exhibits the strongest average comovement with GDP ( $\rho \approx 0.507$ ), followed by Total ( $\rho \approx 0.475$ ) and Federal ( $\rho \approx 0.472$ ). State is slightly weaker ( $\rho \approx 0.426$ ), and 13% Derivation is the least synchronized on average ( $\rho \approx 0.400$ ). Combined with the rolling results (Section 3.2), the correlations tighten to near-unity during 2015–2019 across tiers and then attenuate after 2020, most noticeably for the derivation component—consistent with a partial decoupling in the post-COVID period.

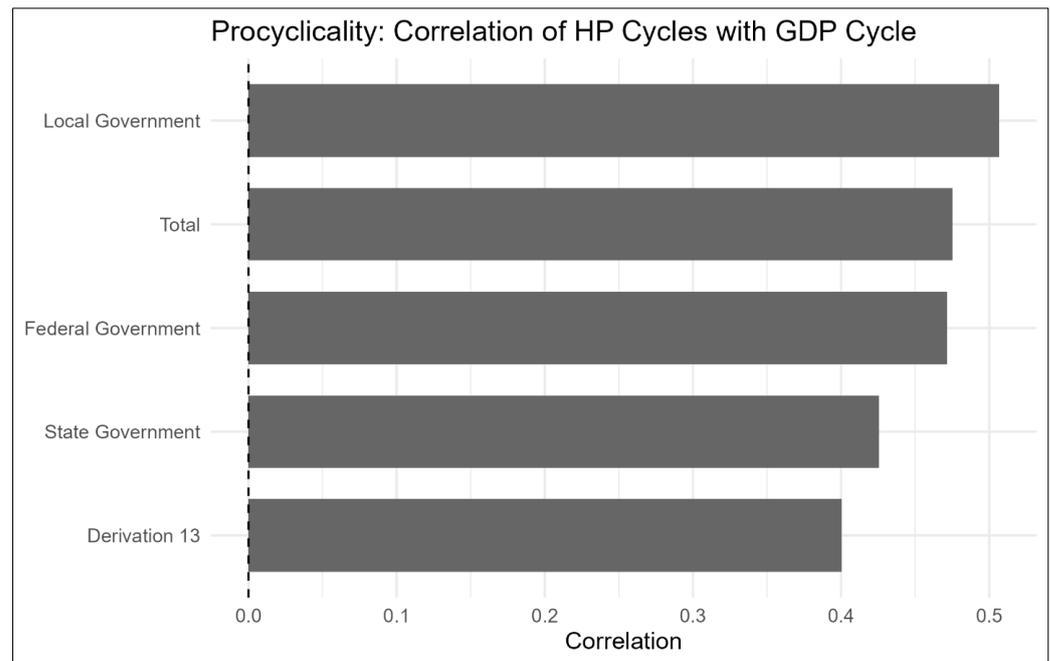
**Table 12** Correlation between each tier’s HP-filtered allocation cycle and the HP-filtered nominal-GDP cycle

Series	corr_cycle_gdp
Federal_Government	0.47
State_Government	0.42
Local_Government	0.51
Derivation_13	0.40
Total	0.47

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**Figure 13. Procyclicality: Correlation of HP cycles with GDP cycle.**

Bars show Pearson correlations between each tier's HP-filtered allocation cycle and the HP-filtered nominal-GDP cycle over 2001–2023 (Local 0.5066; Total 0.4752; Federal 0.4717; State 0.4258; Derivation 0.4004). Higher values indicate stronger procyclicality.

#### 4. Discussion

This study provides comprehensive empirical evidence that Nigeria's intergovernmental fiscal transfer system, as operationalized through the FAAC framework, remains structurally procyclical, weakly elastic in the long run, and highly exposed to macroeconomic and oil-price volatility. Such behavior is characteristic of revenue-sharing systems in resource-dependent federations, where transfers are tightly linked to volatile commodity rents rather than diversified tax bases (Frankel et al., 2013 and van der Ploeg). By integrating ARDL-based long-run elasticity, rolling buoyancy estimates, volatility diagnostics, and cycle-synchronized procyclicality measures, the analysis reveals a fiscal architecture that amplifies economic fluctuations rather than cushioning them—particularly during periods of external shocks, consistent with evidence from developing and emerging economies (Ilzetzki & Végh, 2008; IMF, 2023).

A central finding is the sub-unitary long-run elasticity of FAAC allocations with respect to nominal GDP ( $\approx 0.48$ – $0.60$  in log–log specifications), alongside near-zero or slightly negative long-run multipliers in the ARDL framework. This apparent paradox is economically meaningful. While allocations grow with GDP over time, they do so less than proportionately, and persistent changes in nominal output do not translate into commensurate increases in distributable revenue. This reflects the institutional design of Nigeria's fiscal system, where FAAC pools are largely driven by oil revenues, statutory formulas, and revenue earmarking rather than broad-based domestic economic activity (Martinez-Vazquez & McNab, 2021; World Bank, 2022). In contrast to tax-based federations—where buoyancy often exceeds unity during growth phases—Nigeria's dependence on hydrocarbon rents weakens the structural linkage between GDP expansion and intergovernmental transfers (Oates, 2020; van der Ploeg, 2011).

Despite this weak long-run pass-through, short-run dynamics tell a markedly different story. Rolling elasticity and cycle-based sensitivity estimates demonstrate pronounced short-run buoyancy and

amplification, particularly during the 2013–2019 period. The surge in rolling  $\beta$  coefficients—reaching values above 8 for pooled allocations and above 12 for the 13% derivation component—indicates that FAAC disbursements responded sharply to cyclical GDP movements during oil-price booms and subsequent adjustments. This pattern is consistent with fiscal reaction functions observed in commodity-exporting economies, where revenue windfalls rapidly feed into public spending during booms but reverse abruptly during downturns (Arezki et al., 2017; Céspedes & Velasco, 2014). As a result, while the fiscal system does not internalize long-run growth, it reacts aggressively to cyclical revenue shocks, magnifying short-term volatility in subnational public finances.

The strong and persistent procyclicality documented across all tiers further reinforces this interpretation. Correlations between FAAC allocations and GDP growth ( $\approx 0.42$ – $0.51$ ) and between HP-filtered cycles ( $\approx 0.40$ – $0.51$ ) consistently indicate that transfers expand during economic upswings and contract during downturns. The synchronization intensifies during crisis-prone periods—most notably 2014–2019—when correlations approach near unity. Such behavior contrasts sharply with the stabilizing role typically expected of intergovernmental transfers in federations, where central transfers are designed to smooth regional shocks and protect subnational service delivery during recessions (Rodden, 2006; Blöchliger et al., 2016). Instead, Nigeria’s FAAC system behaves as a transmission channel for macroeconomic volatility.

The volatility analysis underscores the fiscal risks embedded in this procyclical design. FAAC allocations are roughly twice as volatile as nominal GDP, with the 13% derivation fund exhibiting extreme instability ( $\text{CoV} \approx 2.3$ ). This volatility ranking—derivation first, followed by federal and pooled allocations—highlights how oil-linked revenue channels transmit shocks directly into the allocation system. For state and local governments, whose expenditure responsibilities are rigid and often wage-heavy, such volatility translates into cash-flow uncertainty, arrears accumulation, and procyclical expenditure cuts during downturns, a pattern widely documented in oil-dependent federations (Gelb & Grasmann, 2010; IMF, 2021). These dynamics undermine fiscal planning and weaken the delivery of essential public services.

From a structural perspective, the gradual decline in the Herfindahl–Hirschman Index (HHI) points to a slow but measurable decentralization trend. The erosion of federal dominance and modest gains by state and local governments suggest incremental redistribution within the FAAC framework. However, the persistence of moderate concentration levels ( $\text{HHI} \approx 0.30$ ) indicates that decentralization remains limited and insufficient to offset the systemic procyclicality of transfers. Importantly, decentralization without stabilization mechanisms may exacerbate fiscal stress at the subnational level, as exposure to volatile revenue streams increases without adequate risk-sharing arrangements (Boadway & Shah, 2009; OECD, 2023).

Taken together, these results reveal a structural asymmetry in Nigeria’s fiscal federalism: weak long-run responsiveness to economic growth coexists with strong short-run amplification of shocks. This asymmetry helps explain why periods of economic expansion do not consistently translate into sustained improvements in subnational fiscal capacity, while downturns trigger sharp contractions in public spending. Similar asymmetries have been observed in other resource-rich federations, where fiscal institutions fail to delink expenditure from volatile revenue cycles (Frankel, 2011; Céspedes & Velasco, 2014). The post-2020 moderation in rolling buoyancy and cycle sensitivity suggests some degree of adjustment following the COVID-19 shock, but the system remains fundamentally procyclical.

Methodologically, the study advances the fiscal federalism literature by demonstrating the value of integrating elasticity, buoyancy, volatility, and cycle synchronization within a unified empirical framework. Static elasticity estimates alone would understate fiscal risk, while correlations without dynamic context would obscure regime shifts. By combining ARDL long-run diagnostics with rolling and cycle-based measures, the analysis captures both equilibrium relationships and time-varying transmission mechanisms—an approach increasingly recommended in contemporary macro-fiscal analysis (Pesaran et al., 2001; Auerbach & Gorodnichenko, 2012).

From a policy standpoint, the findings carry clear implications. A fiscal transfer system that is both volatile and procyclical undermines macroeconomic stabilization, exacerbates regional inequalities, and constrains development planning. Reforming Nigeria's FAAC architecture therefore requires explicit countercyclical design features, such as stabilization funds, smoothing rules based on multi-year revenue averages, and greater reliance on non-oil tax bases—measures shown to improve fiscal resilience in other resource-dependent economies (IMF, 2023; World Bank, 2022). Without such reforms, incremental decentralization alone is unlikely to deliver fiscal resilience or equitable development outcomes.

In sum, this study shows that Nigeria's intergovernmental fiscal transfers are structurally ill-suited to act as automatic stabilizers. The dominance of oil-linked revenues, combined with formula-based distribution and limited buffering mechanisms, results in a system that amplifies rather than absorbs macroeconomic shocks. Addressing these structural weaknesses is essential if fiscal federalism is to support macroeconomic stability, subnational service delivery, and long-term development in Nigeria (Oates, 2020; Martinez-Vazquez & McNab, 2021).

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#### **Informed Consent Statement**

Not applicable.

#### **Data Availability Statement**

The data presented in this study are available from the corresponding author upon reasonable request.

#### **Conflicts of Interest**

The authors declare no conflict of interest.

#### **Abbreviation**

ARDL – Autoregressive Distributed Lag

CBN – Central Bank of Nigeria

CoV – Coefficient of Variation

ECM – Error Correction Model

FAAC – Federation Account Allocation Committee

GDP – Gross Domestic Product

HHI – Herfindahl–Hirschman Index

HP – Hodrick–Prescott (filter)

OLS – Ordinary Least Squares

YoY – Year-on-Year

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