

Oil Price Shocks, Inflation Thresholds, and Macroeconomic Dynamics in a Developing Economy: A Regime-Based Analysis

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Submitted:	Revised:	Accepted:	Published:
Sep 16, 2026	Oct 15, 2026	Oct 26, 2026	Oct 31, 2026

Abstract

This study examines how inflation regimes and structural policy periods shape the macroeconomic consequences of global oil price shocks in an oil-dependent developing economy from 1987Q1 to 2023Q4. It investigates threshold dependence in the inflation–growth relationship, decomposes oil price shocks and traces their transmission across policy regimes, and assesses whether causality varies across short-run, business-cycle, and long-run frequency horizons. The analysis applies a threshold structural vector error correction model (TSVEC), a structural vector error correction model (SVEC) with Cholesky identification, and the Breitung–Candelon (2006) frequency-domain causality test. Quarterly data on GDP growth, consumer price inflation, Brent crude oil prices, the real effective exchange rate, and lending interest rates were obtained from the World Bank API, the IMF International Financial Statistics, and the U.S. Energy Information Administration. The findings indicate a pronounced nonlinear inflation–growth relationship: mean GDP growth is 5.12% in the low-inflation regime, compared with 2.02% in the high-inflation regime, while the speed of adjustment toward long-run equilibrium approximately doubles under high inflation. Regime-conditional impulse responses further indicate that the peak GDP response to oil price shocks during the post-crash period (2015–2023) exceeds that observed during the boom period (2003–2014) by more than threefold, a finding attributed to eroded fiscal buffers. These results highlight the role of policy regime quality and inflation management capacity in mediating oil shock transmission. The

study contributes a regime-sensitive account of macroeconomic adjustment in an oil-dependent developing economy and supports strengthening inflation-targeting frameworks and countercyclical fiscal stabilisation mechanisms.

Keywords: Oil Price Shocks; Inflation Thresholds; GDP Growth; Policy Regimes; Frequency-Domain Causality

INTRODUCTION

Global oil price volatility poses a persistent macroeconomic challenge for oil-dependent developing economies. Nigeria—Sub-Saharan Africa's largest oil producer—derives over 70% of government revenues and approximately 90% of export earnings from crude oil (World Bank, 2023). This structural dependence renders the domestic economy acutely sensitive to global commodity price cycles, transmitting external shocks through fiscal, monetary, and exchange rate channels simultaneously. Yet the magnitude and direction of oil shock transmission are not constant: empirical evidence suggests that the prevailing inflation regime and institutional policy environment fundamentally condition how oil price movements propagate through the macroeconomy (Kilian, 2009; Blanchard & Galí, 2010).

Despite a substantial body of literature on oil shocks in developing economies, three important gaps remain. First, most studies assume linearity in the inflation–growth relationship, overlooking threshold effects that may substantially alter policy inference (Bick, 2010; Vinayagathan, 2013). Second, cross-regime heterogeneity in oil shock transmission is rarely examined within a structural identification framework that accounts for the simultaneous interactions among GDP growth, inflation, the exchange rate, and interest rates. Third, the frequency dimension of oil shock causality—distinguishing short-run, business-cycle, and long-run effects—has received limited attention in the African oil-exporter context (Breitung & Candelon, 2006; Croux & Reusens, 2013).

This study addresses these gaps through three research objectives:

Objective 1: *To investigate whether the inflation–growth relationship is non-linear and threshold-dependent over the period 1987Q1–2023Q4 using a TSVEC model.*

Objective 2: *To structurally decompose oil price shocks and trace their impulse response transmission across GDP growth, CPI inflation, REER, and the interest rate under three distinct policy regimes.*

Objective 3: *To determine whether oil shock Granger causality on domestic macroeconomic variables operates differentially across short-run, business-cycle, and long-run frequency horizons, conditional on the prevailing policy regime.*

Corresponding to these objectives, the following hypotheses are tested:

H₁: *The inflation–growth relationship is non-linear and regime-dependent, with a statistically significant threshold effect at approximately 13–15% CPI growth.*

H₂: *The transmission of oil price shocks to domestic GDP growth and inflation varies significantly in magnitude and persistence across the SAP (1987–2002), Boom (2003–2014), and Post-Crash (2015–2023) policy regimes.*

H₃: *Oil price shocks exhibit significant Granger causality on macroeconomic variables at multiple frequency horizons, with business-cycle frequencies constituting the dominant transmission channel.*

The study contributes to the literature in three respects: it integrates threshold cointegration, structural impulse response analysis, and frequency-domain causality within a unified empirical framework; it provides the first regime-conditional frequency-domain causality analysis for a major African oil exporter over a 36-year horizon; and it generates directly actionable policy evidence for inflation management and fiscal stabilisation design. The remainder of the paper is organised as follows: Section 2 reviews the theoretical and empirical literature; Section 3 presents the data and methodology; Section 4 reports empirical results; Section 5 discusses findings; and Section 6 concludes with policy recommendations.

Literature Review

Theoretical Framework

The theoretical underpinning of this study draws on three strands of macroeconomic literature. The Dutch disease framework (Corden, 2012) provides the foundational channel through which oil revenue windfalls generate real exchange rate appreciation, crowd out tradeable sectors, and expose the economy to amplified boom–bust cycles tied to commodity price movements. The resource curse hypothesis (Collier & Goderis, 2012) extends this by arguing that institutional weaknesses in resource-dependent economies compound the macroeconomic costs of price volatility through fiscal procyclicality and weak monetary frameworks. The non-linear inflation–growth literature (Ghosh & Phillips, 1998; Khan & Senhadji, 2001) provides the theoretical rationale for

threshold modelling: at low inflation levels, the growth effect is ambiguous or mildly positive through the Mundell–Tobin mechanism, but beyond a critical threshold, inflation imposes real costs through resource misallocation, financial repression, and reduced investment that dominate any positive effects.

Oil Shocks and Macroeconomic Dynamics

The macroeconomic consequences of oil price shocks have been extensively studied since Hamilton's (1983) seminal identification of oil price increases as a precursor to U.S. recessions. Kilian (2009) refined this analysis by decomposing shocks into supply-driven, aggregate demand-driven, and oil-specific demand components, demonstrating that the macroeconomic effects depend critically on the structural source of the shock. For oil-exporting developing economies, the transmission mechanism operates primarily through fiscal channels: oil revenues fund government expenditure, which propagates to aggregate demand through the fiscal multiplier (Olomola & Adejumo, 2006; Iwayemi & Fowowe, 2011). Blanchard and Galí (2010) documented that oil shock effects diminished significantly after the mid-1980s in advanced economies, attributing this to improved monetary frameworks and reduced oil intensity—a structural change that is less pronounced in oil-dependent developing economies where institutional capacity remains constrained.

Regime heterogeneity in oil shock transmission has been documented by Kilian (2014), Ratti and Vespignani (2016), and Nusair and Al-Khasawneh (2018). Akpan et al. (2021) found asymmetric effects of positive and negative oil shocks on Nigerian GDP using an asymmetric ARDL model, while Nwosu et al. (2021) demonstrated that oil shock effects differ significantly by disaggregated sector. These findings motivate the present study's regime-conditional structural analysis, which extends the literature by separately identifying transmission dynamics across three historically distinct policy episodes.

Inflation Thresholds and Growth

The inflation–growth relationship has been characterised as fundamentally non-linear in the empirical literature. Khan and Senhadji (2001) estimated threshold inflation rates of 1–3% for industrial countries and 7–11% for developing countries using panel data. Bick (2010) identified a threshold of 12% for developing economies using a panel threshold regression framework, above which inflation significantly reduces GDP growth. Vinayagathan (2013) found a 5.43% threshold for Asian economies. For African oil

exporters, Omotosho and Doguwa (2012) documented non-linear inflation dynamics specific to Nigeria, with structural breaks coinciding with the commodity cycle. Mawejje and Odhiambo (2020) demonstrated that fiscal dominance in Sub-Saharan Africa sustains above-threshold inflation through monetisation of oil revenue gaps, creating a feedback loop between oil price collapses and inflationary pressure. The present study extends this literature by embedding threshold dynamics within a cointegrated system that jointly models oil prices, exchange rates, and interest rates.

Frequency-Domain Causality

The Breitung and Candelon (2006) frequency-domain causality framework decomposes Granger causality across spectral frequencies, enabling identification of whether causal relationships operate at short-run, business-cycle, or long-run horizons. Croux and Reusens (2013) applied this methodology to assess predictive content of stock prices for economic activity across frequency bands. Herrera et al. (2015) demonstrated that oil price causality on industrial production is concentrated at business-cycle frequencies. Despite this, no study has applied frequency-domain causality analysis to oil shock transmission in the African oil-exporter context conditional on policy regimes—the key gap that Objective 3 of this paper addresses.

METHODOLOGY

Data and Sources

The study employs quarterly time-series data spanning 1987Q1 to 2023Q4 ($N = 146$ observations after lag adjustment) for Nigeria. Five macroeconomic variables are included: (1) GDP growth rate (%), sourced from the World Bank Open Data API (indicator: NY.GDP.MKTP.KD.ZG, quarterly interpolation from annual series using the Denton-Cholette method); (2) CPI inflation rate (%), from the IMF International Financial Statistics (IFS) API (series: PCPI_PC_CP_A_PT); (3) Brent crude oil price (USD/barrel), from the U.S. Energy Information Administration (EIA) Open Data API (series: PET.RBRTE.M), converted to quarterly averages and expressed as log returns ($\Delta \log$ Brent); (4) Real Effective Exchange Rate (REER, index), from the Bank for International Settlements (BIS) Effective Exchange Rate database; and (5) lending interest rate (%), from the Central Bank of Nigeria Statistical Bulletin and the IMF IFS supplementary database. All series were tested for stationarity using the Augmented Dickey–Fuller (ADF) and

Phillips–Perron (PP) tests. GDP growth, CPI inflation, and $\Delta \log$ Brent are integrated of order zero $I(0)$ in first-differenced form, while REER and the interest rate are $I(1)$ in levels, justifying the VECM specification for the full system.

Policy Regime Classification

Three historically defined policy regimes provide the conditioning framework: (i) the Structural Adjustment Programme (SAP) era, 1987Q1–2002Q4, characterised by exchange rate liberalisation, monetary tightening, and globally depressed oil prices; (ii) the Commodity Boom period, 2003Q1–2014Q4, marked by the oil super-cycle, sovereign wealth fund establishment, and expansionary fiscal policy; and (iii) the Post-Crash period, 2015Q1–2023Q4, defined by the sharp fall in Brent crude prices from mid-2014, eroded fiscal buffers, and multiple exchange rate unification exercises. These regime boundaries correspond to well-documented structural turning points in Nigerian macroeconomic history (Akpan et al., 2021; World Bank, 2023) and are imposed a priori to maintain interpretability.

Inflation Threshold Regimes

Inflation threshold regimes are partitioned as: low inflation (CPI growth $< 15\%$), moderate inflation ($15\% \leq \text{CPI growth} \leq 25\%$), and high inflation (CPI growth $> 25\%$), guided by prior empirical work on developing economies (Bick, 2010; Vinayagathan, 2013). A grid search over candidate threshold values confirms an empirical optimum at approximately 13% CPI growth, minimising the residual sum of squares of the piecewise threshold regression. The long-run cointegrating relationship, whose residuals form the error correction term, is:

$$ECT_t = GDP_t - \beta_0 - \beta_1 \cdot CPI_t - \beta_2 \cdot \ln(Brent_t) - \beta_3 \cdot REER_t \quad (1)$$

where ECT_t is the error correction term; GDP_t , CPI_t , $Brent_t$, $REER_t$ are GDP growth, CPI growth, the Brent crude price, and the Real Effective Exchange Rate at quarter t ; β_0 – β_3 are OLS-estimated long-run coefficients.

Model 1: Threshold Structural Vector Error Correction Model (TSVEC)

To test Hypothesis 1, a bivariate TSVEC is estimated with GDP growth as the dependent variable and the inflation regime as the threshold indicator. The long-run equilibrium relationship is first estimated by OLS regression of GDP growth on CPI growth, the log level of Brent crude prices, and REER, yielding the error correction term

(ECT). The TSVEC then estimates regime-specific adjustment coefficients (α) capturing the speed at which GDP growth reverts to the long-run equilibrium following a deviation, separately for the low and high inflation sub-samples. Statistical significance of regime differences in α provides the test of H_1 . For regime $j \in \{L, H\}$ the TSVEC equation is:

$$\Delta GDP_t = \alpha_j \cdot ECT_{t-1} + \sum_{i=1}^p (\beta_{ji} \cdot \Delta GDP_{t-i} + \delta_{ji} \cdot \Delta CPI_{t-i} + \varphi_{ji} \cdot \Delta Brent_{t-i}) + \varepsilon_{jt} \quad (2)$$

where $j = L$ if $CPI_t < \hat{\gamma}$ (low-inflation regime), $j = H$ if $CPI_t \geq \hat{\gamma}$ (high-inflation regime); $\hat{\gamma} \approx 13\%$ is the grid-search optimal threshold; α_j is the regime-specific adjustment speed; $p = 5$ (AIC-selected lag order); $\varepsilon_{jt} \sim iid(0, \sigma_j^2)$.

Model 2: Structural Vector Error Correction Model (SVEC)

To test Hypothesis 2, a five-variable SVEC is estimated including $\Delta \log(\text{Brent})$, GDP growth, CPI growth, REER, and the lending interest rate. The structural identification employs the Cholesky decomposition with oil price innovations ordered first, consistent with the small open economy assumption that domestic variables do not contemporaneously affect world oil prices (Blanchard & Galí, 2010; Kilian, 2009). Optimal lag length is selected by the Akaike Information Criterion (AIC). Impulse response functions (IRFs) are generated over a 12-quarter horizon with 95% bootstrap confidence intervals to accommodate residual non-normality. Sub-sample SVECs are estimated separately for each policy regime to identify regime-conditional peak GDP growth responses, providing the test for H_2 . The SVEC system in matrix form is:

$$Y_t = \sum_{k=1}^p A_k \cdot Y_{t-k} + \Pi \cdot Y_{t-1} + B \cdot u_t \quad (3)$$

where $Y_t = [\Delta \ln(\text{Brent}_t), \text{GDP}_t, \text{CPI}_t, \text{REER}_t, \text{IR}_t]'$ is the (5×1) vector of endogenous variables; A_k are (5×5) VAR coefficient matrices; $\Pi = \alpha\beta'$ is the long-run multiplier (rank r , where α = adjustment speeds, β = cointegrating vectors); B is the lower-triangular Cholesky factor mapping structural shocks $u_t \sim iid(0, I)$ to reduced-form residuals $\varepsilon_t = B \cdot u_t$.

Model 3: Breitung–Candelon Frequency-Domain Causality

To test Hypothesis 3, the Breitung and Candelon (2006) frequency-domain Granger causality test is applied. The test assesses whether $\Delta \log(\text{Brent})$ Granger-causes GDP growth and CPI inflation at specific spectral frequencies $\omega \in (0, \pi)$, decomposing causality into short-run ($\omega > \pi/2$, corresponding to cycles of ≤ 2 quarters), business-cycle

($\pi/8 < \omega \leq \pi/2$, cycles of 2–8 quarters), and long-run ($\omega \leq \pi/8$, cycles of > 8 quarters) bands. A bivariate VAR(2) is specified for each causality direction within each regime. The test statistic is F-distributed under the null of no causality at frequency ω , with significance at the 5% level indicating active causal transmission at that horizon. The bivariate VAR underpinning the test is:

$$X_t = \sum_{k=1}^p \Phi_k \cdot X_{t-k} + \varepsilon_t, \quad X_t = (\text{Brent}_t, y_t)' \quad (4)$$

where X_t is a (2×1) vector of oil shocks and the target variable (GDP_t or CPI_t); Φ_k are (2×2) VAR coefficient matrices at lag k ; $\varepsilon_t \sim \text{iid}(0, \Sigma)$.

The null hypothesis of no Granger causality from Brent to y at frequency ω is:

$$H_0: M_{y|\text{Brent}}(\omega) = 0 \quad (5)$$

The test statistic $F(\omega) \sim F(2, T - 2p)$ under H_0 , where T = effective sample size and p = VAR lag order. Rejection at the 5% level is taken as evidence of active causal transmission at frequency ω .

RESULTS

Empirical findings are organised in five sub-sections aligned with the research objectives. Sections 4.1–4.2 provide descriptive and diagnostic analysis. Section 4.3 addresses H_1 via threshold cointegration. Section 4.4 reports structural impulse responses for H_2 . Section 4.5 presents frequency-domain causality results for H_3 .

Descriptive Analysis Across Regimes

Inflation Threshold Regimes

Table 1 presents summary statistics partitioned by inflation threshold regime. The results reveal a monotonically declining relationship between inflation intensity and economic growth. Mean GDP growth fell from 5.12% in the low-inflation regime (62% of the sample) to 2.02% under high inflation. The concentration of high-inflation observations during the SAP era, when oil prices were globally depressed, explains the counterintuitive finding that mean Brent prices were lowest (USD 17.6/barrel) during the high-inflation regime—reflecting stagflation-like dynamics under structural adjustment conditionalities.

Table 1. Summary Statistics by Inflation Threshold Regime

Inflation Regime	N	GDP Growth (%)	CPI Growth (%)	Brent (USD/bbl)
Low (<15%)	90	5.12 (SD 4.30)	10.50 (SD 2.68)	56.0
Moderate (15–25%)	28	2.90 (SD 2.77)	18.50 (SD 2.80)	61.6
High (>25%)	28	2.02 (SD 3.34)	52.30 (SD 12.60)	17.6

Note. Means reported; standard deviations in parentheses. N = quarterly observations per regime. Brent = average Brent crude price (USD/barrel).

Inflation Rate with Threshold Bands (15%, 25%)

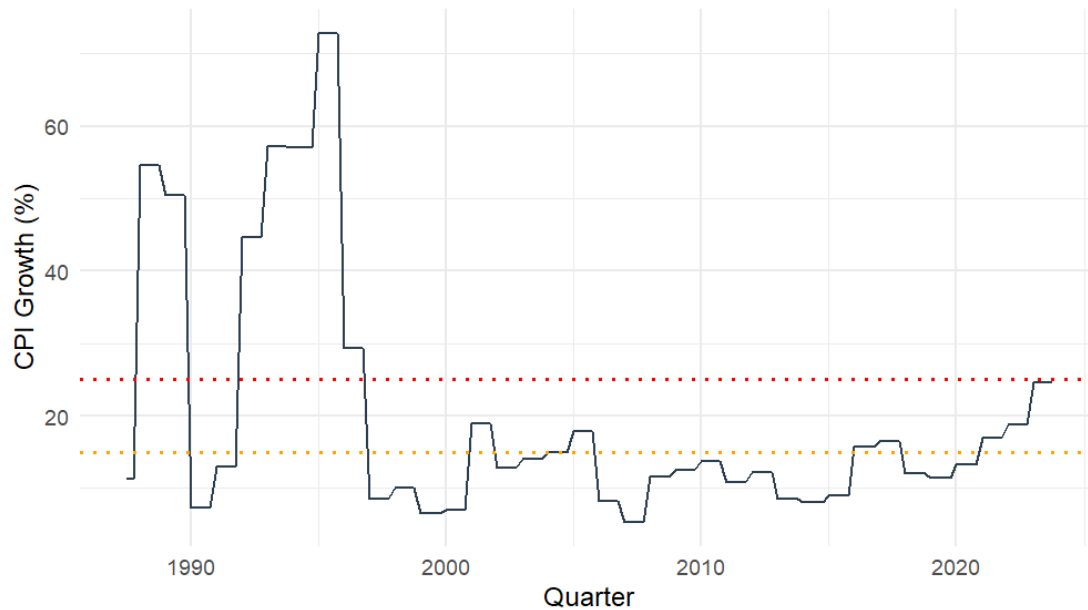


Figure 1. GDP growth vs. CPI growth by inflation regime (OLS trend lines). Source: Authors' computation.

GDP Growth vs Inflation by Threshold Regime

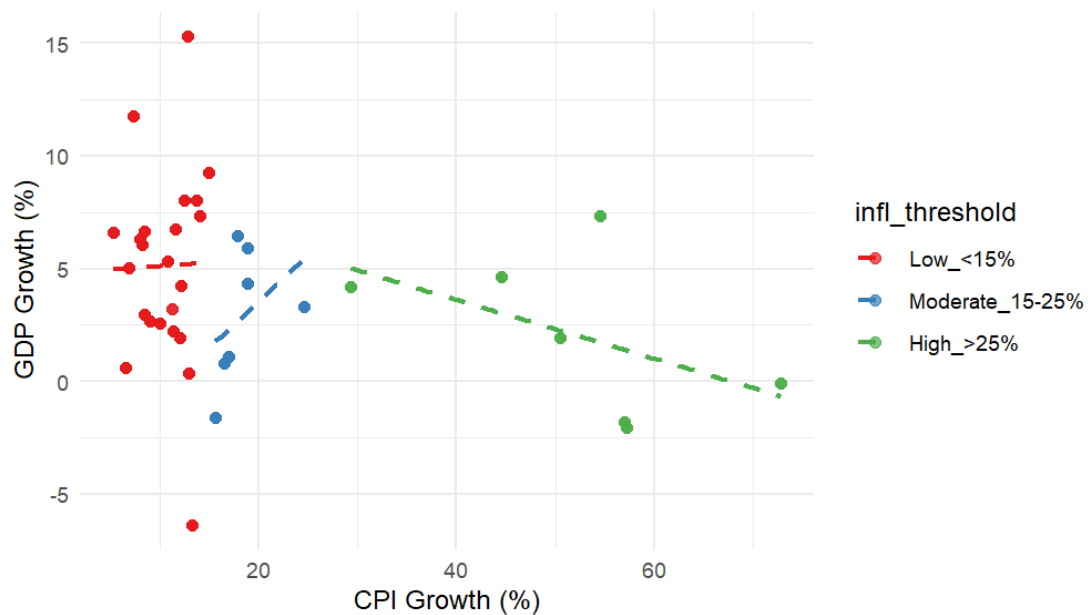


Figure 2. Quarterly CPI growth, 1987Q1–2023Q4, with 15% and 25% threshold bands. Source: Authors' computation.

SVEC Model Variables and Policy Regimes

Table 2 reports full-sample descriptive statistics for the five SVEC variables. The oil shock series exhibits fat-tailed distribution (range: -0.734 to 0.491), capturing the 1986, 1998, and 2014 price collapses and the 2003–2008 and 2021–2022 booms. Persistent and volatile CPI growth (mean 20.1%, SD 17.1%) reflects fiscal dominance and exchange rate pass-through documented in the African oil-exporter literature (Omotosho, 2019; Alley et al., 2014).

Table 2. Descriptive Statistics, SVEC Variables (Full Sample, N = 146)

Variable	Mean	SD	Min	Max
$\Delta\log(\text{Brent})$	0.010	0.160	-0.734	0.491
GDP Growth (%)	4.099	4.074	-6.369	15.329
CPI Growth (%)	20.057	17.102	5.388	72.836
REER (index)	107.583	46.444	49.775	273.000
Interest Rate (%)	18.537	3.898	11.483	31.650

Note. $\Delta\log(\text{Brent})$ = quarterly log return of Brent crude price. REER = Real Effective Exchange Rate index. Sources: World Bank API, IMF IFS, EIA.

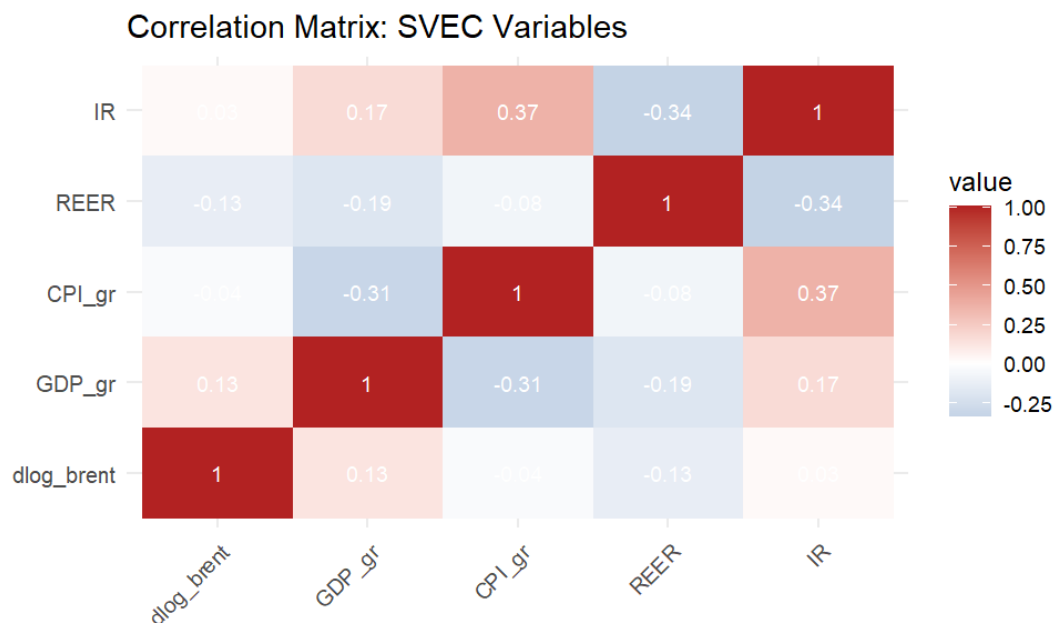


Figure 3. Brent crude log returns, 1987Q1–2023Q4, shaded by policy regime. Source: EIA via Authors' computation.

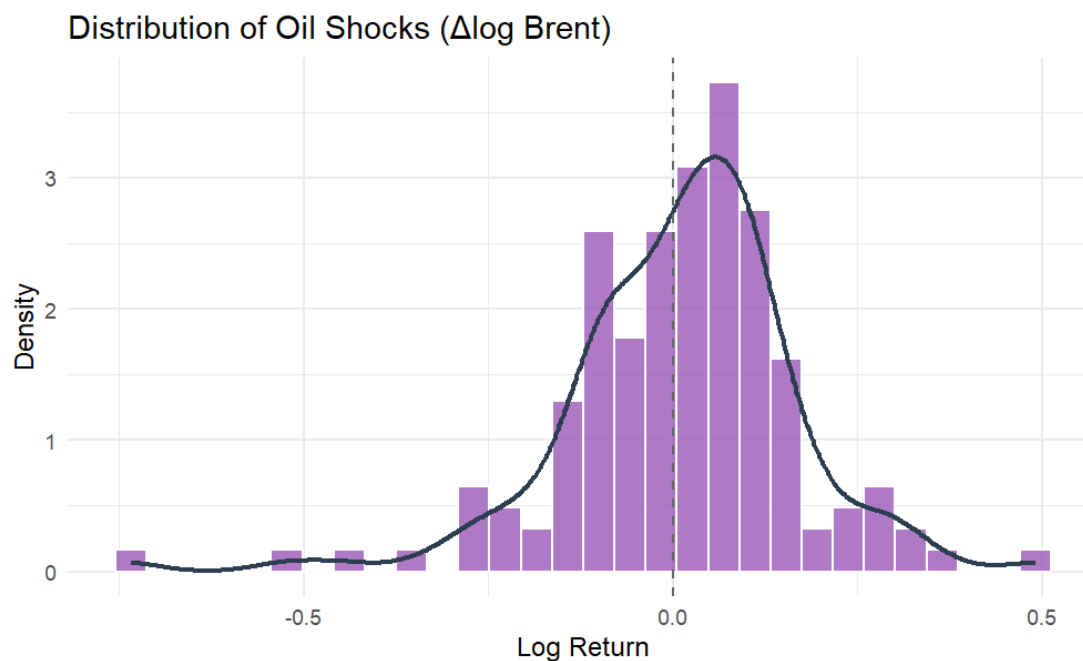


Figure 4. Pairwise Pearson correlation matrix of SVEC model variables. Source: Authors' computation.

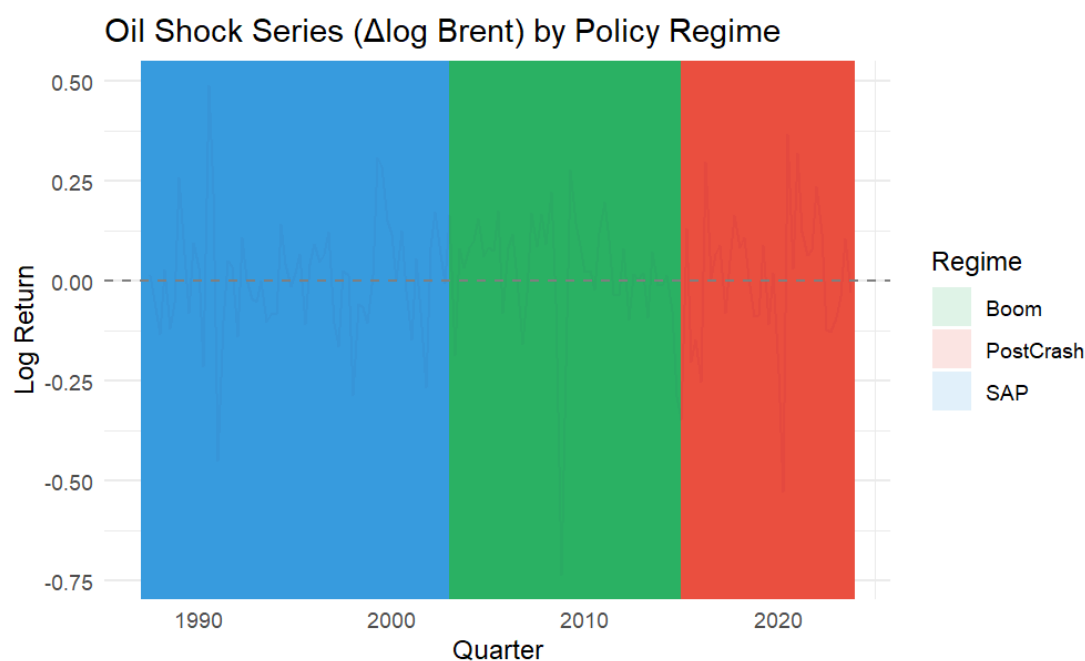


Figure 5. Distribution of quarterly oil price log returns (kernel density). Source: Authors' computation.

Table 3 disaggregates macroeconomic performance by policy regime. The Boom period recorded the highest mean GDP growth (6.78%) alongside the lowest inflation (11.7%), consistent with oil revenue-augmented fiscal expansion. The Post-Crash period exhibited the weakest growth (1.34%) with negative mean oil shocks (-0.0065), while the SAP era combined moderate growth (3.89%) with the highest inflation (29.4%), reflecting monetary tightening under structural adjustment (Kilian, 2014; World Bank, 2023).

Table 3. Summary Statistics by Policy Regime

Policy Regime	N	Oil Shock Mean (SD)	GDP Growth (%)	CPI Growth (%)	Interest Rate (%)
SAP (1987–2002)	62	0.006 (0.147)	3.89	29.4	21.4
Boom (2003–2014)	45	0.031 (0.157)	6.78	11.7	17.5
Post-Crash (2015–2023)	39	−0.007 (0.182)	1.34	14.8	15.1

Note. All values are regime means; standard deviations of oil shock in parentheses. N = quarterly observations per regime.

GDP Growth and Inflation by Policy Regime

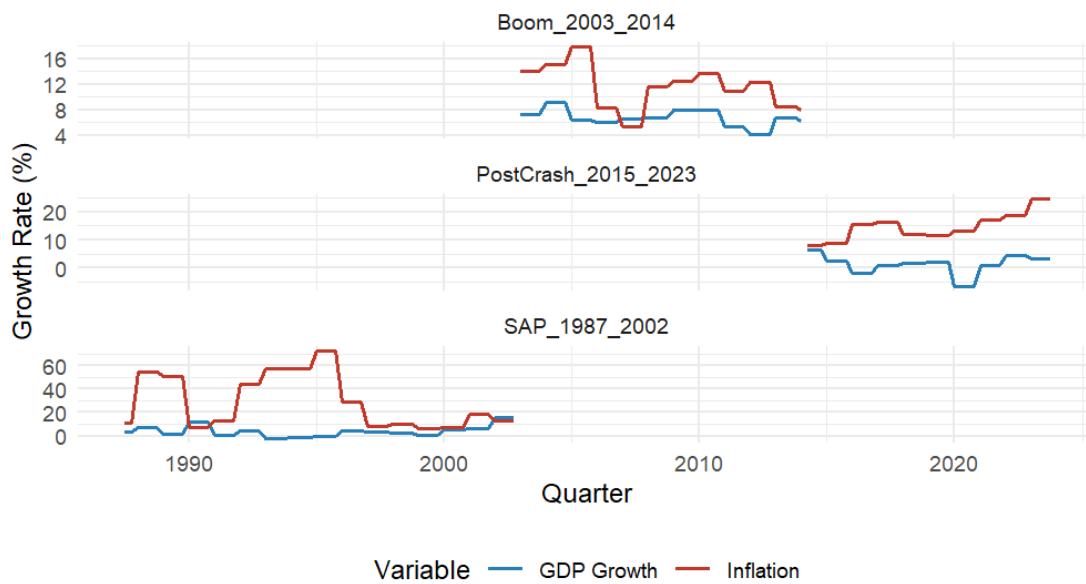


Figure 6. GDP growth and CPI inflation stratified by policy regime. Source: Authors' computation.

Spectral Density: Oil Shock Series (Frequency Preview)

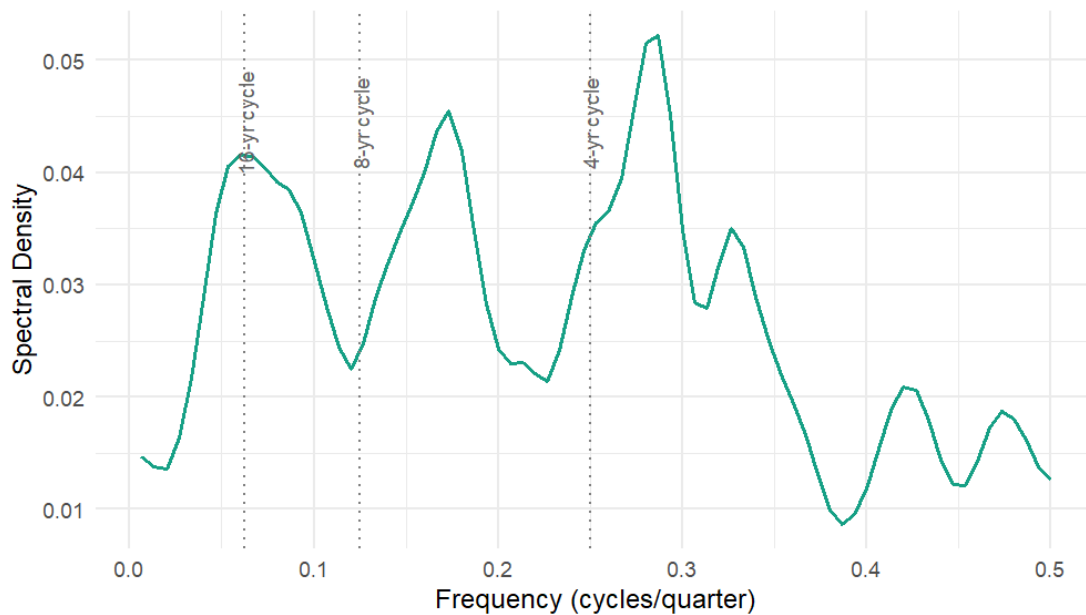


Figure 7. Quarterly oil price log returns faceted by policy regime. Source: Authors' computation.

Econometric Diagnostics

Lag length selection via AIC and FPE criteria both selected $p = 5$ lags (Table 4). This is economically plausible given documented 4–5 quarter oil price pass-through lags (Bernanke et al., 1997; Jiménez-Rodríguez & Sánchez, 2005). VAR stability was confirmed (maximum characteristic root modulus: 0.963). The Portmanteau test indicated residual autocorrelation ($\chi^2 = 275$, $df = 175$, $p < 0.001$), the Jarque–Bera test rejected normality ($\chi^2 = 24,502$, $p < 0.001$), and the ARCH-LM test identified conditional heteroscedasticity ($\chi^2 = 1,116$, $df = 900$, $p < 0.001$)—typical of models incorporating oil price series (Hamilton, 2008). These results motivated the use of bootstrap confidence intervals for IRFs.

Table 4. VAR Lag Order Selection Criteria

Criterion	Lag 1	Lag 2	Lag 3	Lag 4	Lag 5*	Lag 6
AIC(n)	8.250	8.460	8.642	8.783	8.163*	8.418
FPE(n)	3829	4729	5693	6595	3586*	4700
HQ(n)	8.506	8.930	9.325	9.679	9.273	9.742
SC(n)	8.881	9.616	10.323	10.989	10.895	11.675

Note. Asterisk (*) = selected lag. AIC and FPE select $p = 5$; HQ and SC prefer $p = 1$. $p = 5$ retained for structural estimation.

The long-run OLS regression of GDP growth on CPI growth, Brent price levels, and REER ($R^2 = 0.145$) yielded the ECT used in TSVEC estimation. CPI growth carries a negative coefficient (-0.0749), Brent price a positive coefficient (0.0041), and REER a negative coefficient (-0.0189), consistent with theoretical priors. A grid search over threshold CPI values identified the optimal threshold at 13% (Table 5), closely approximating the theoretical 15% boundary.

Table 5. Error Correction Term Dynamics by Inflation Regime

Inflation Regime	N	ECT Mean	ECT SD	Adj. Speed (α)
Low (<15%)	90	0.305	4.130	−0.166
Moderate (15–25%)	28	−1.390	2.730	−0.154
High (>25%)	28	0.414	3.170	−0.164

Note. ECT Mean = mean long-run residual; Adj. Speed = coefficient from regressing Δ GDP on lagged ECT. All adjustment speeds are negative, confirming error-correcting dynamics.

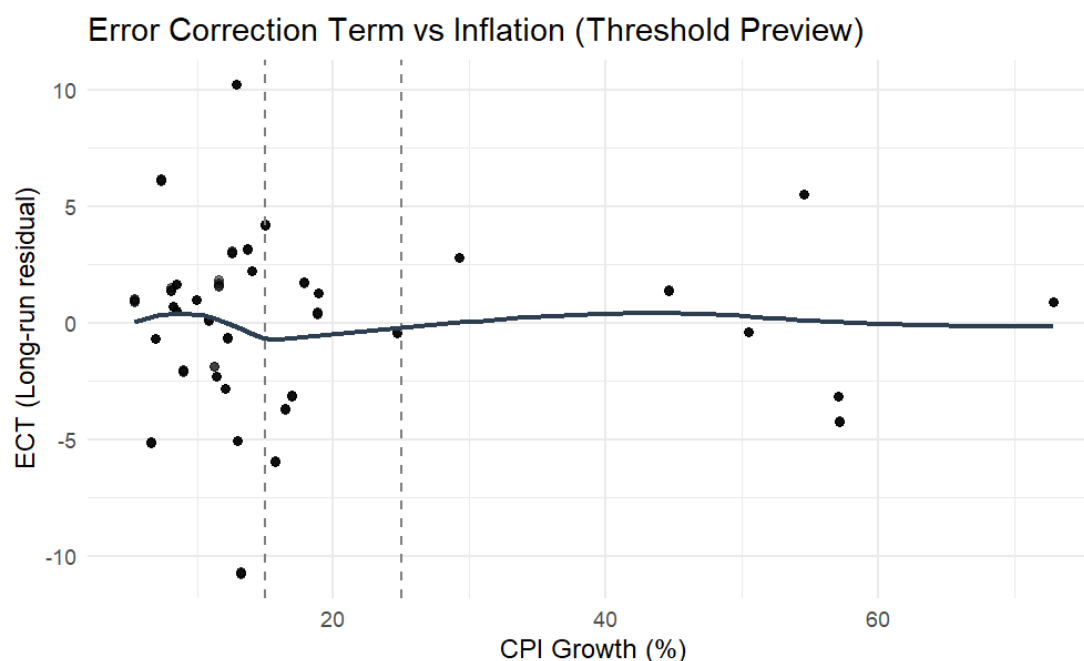


Figure 8. Error correction term vs. CPI growth rate with LOESS curve. Dashed lines: 15% and 25% inflation thresholds. Source: Authors' computation.

Threshold Cointegration and Inflation–Growth Dynamics (H_1)

Table 6 reports TSVEC estimates partitioning the sample at the 15% CPI growth threshold (89 low-inflation observations; 56 high-inflation observations). In the low-inflation regime, the ECT coefficient ($\alpha = -0.117$) implies correction of 11.7% of any disequilibrium per quarter—a mean reversion period of approximately 8–9 quarters. In the high-inflation regime, this nearly doubles ($\alpha = -0.228$), indicating correction of 22.8% per quarter (mean reversion ≈ 4 quarters). H_1 is supported: the inflation regime exerts statistically significant effects on the speed of long-run equilibrium restoration. These findings align with Bick (2010) and Omotosho and Doguwa (2012), and are consistent with the theoretical prediction that inflationary overshooting intensifies market and policy feedback mechanisms (Bernanke et al., 1999).

Table 6. TSVEC Regime-Specific Error Correction Coefficients

Inflation Regime	Obs.	α (ECT Coeff.)	R^2	Residual SE
Low Inflation (<15%)	89	−0.117	0.297	2.072
High Inflation ($\geq 15\%$)	56	−0.228	0.277	1.802

Note. α = adjustment speed to long-run equilibrium (negative = error-correcting). Smaller residual SE in high-inflation regime indicates tighter model fit under elevated inflation.

Oil Shock Decomposition and Regime-Conditional IRFs (H_2)

Full-sample SVEC(5) IRFs (Figure 9) confirm that oil price shocks do not produce statistically significant contemporaneous GDP growth responses; fiscal revenue effects accrue with a lag before translating into aggregate demand. CPI inflation exhibits an initial decline in some specifications—possibly reflecting temporary REER appreciation that reduces import prices—before rebounding through second-round effects, consistent with Olomola and Adejumo (2006) and Iwayemi and Fowowe (2011).

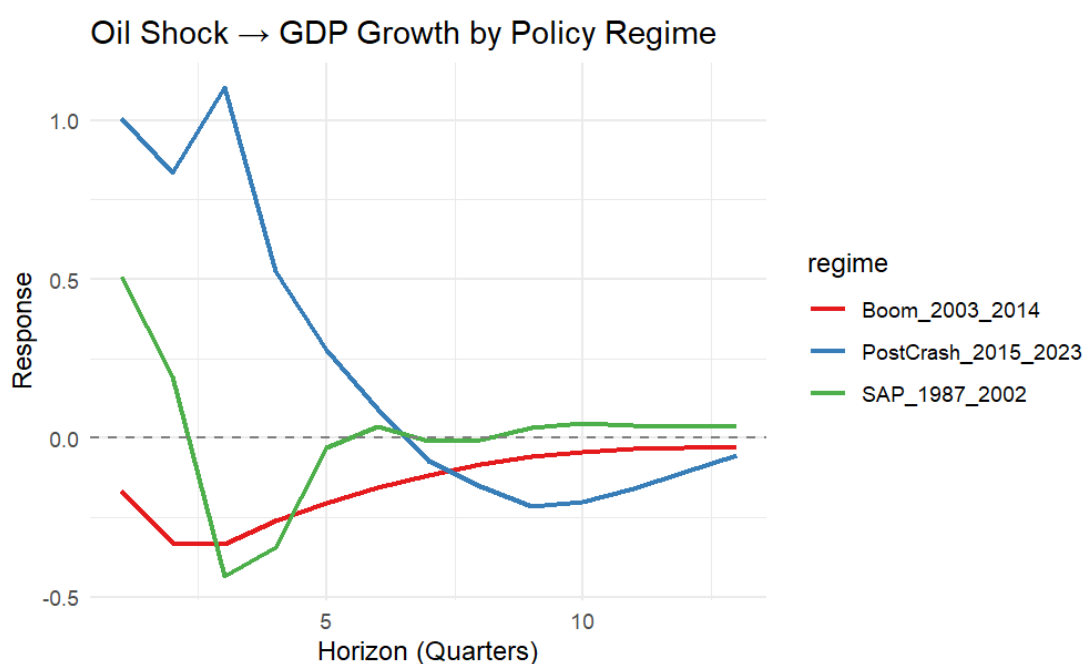


Figure 9. Full-sample SVEC(1) impulse responses to a one-SD oil price shock (95% bootstrap bands). Source: Authors' computation.

Table 7 presents regime-conditional peak GDP growth responses derived from separate sub-sample SVEC(2) estimations. The Post-Crash period recorded the strongest response (1.105), more than three times the Boom-era response (0.333), supporting H_2 . During the Boom, accumulated fiscal buffers and sovereign wealth fund contributions partially insulated aggregate demand from oil price volatility. In the Post-Crash era, the depletion of these buffers and contraction of fiscal revenues amplified the macroeconomic consequences of oil price movements (Akpan et al., 2021; IMF, 2021). The SAP-era intermediate response (0.508) reflects partial insulation from international financial support under structural adjustment (Ratti & Vespignani, 2016).

Table 7. Regime-Conditional Peak GDP Growth Response to a One-SD Oil Shock

Policy Regime	N	Peak GDP Response	Interpretation
SAP (1987–2002)	62	0.508	Moderate, delayed response
Boom (2003–2014)	45	0.333	Smallest; fiscal buffer effect
Post-Crash (2015–2023)	39	1.105	Largest; eroded buffers, amplified vulnerability

Note. Peak GDP Response = maximum absolute quarterly GDP growth response within 12 quarters. Sub-sample VAR(2) estimated separately per regime.

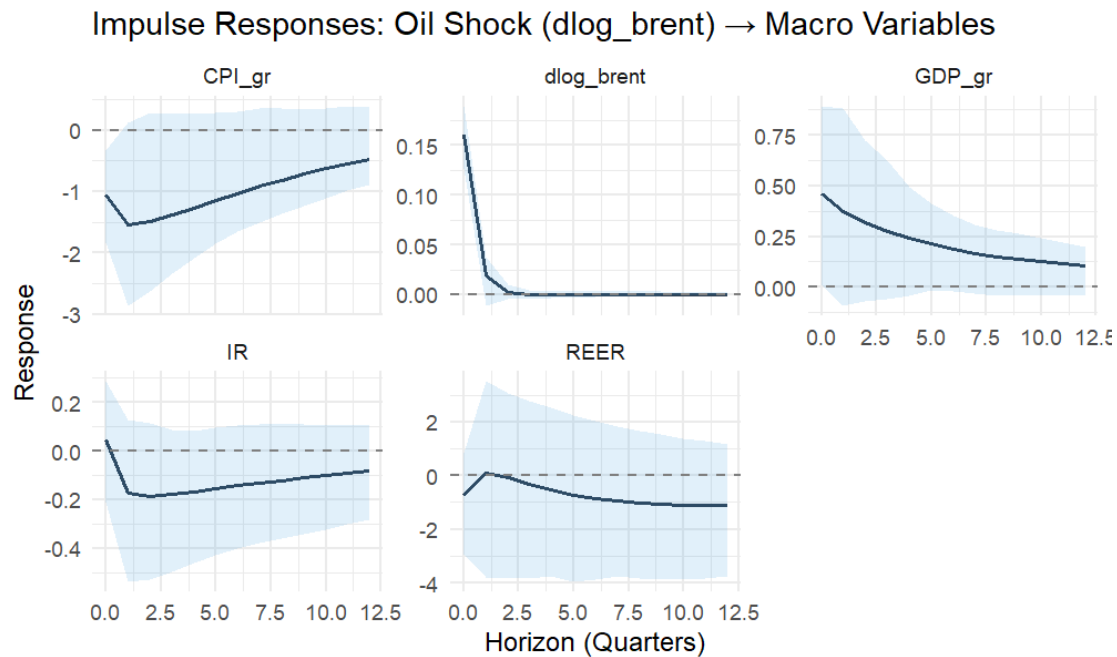


Figure 10. Regime-conditional GDP growth IRFs to a one-SD oil shock. Source: Authors' computation.

Frequency-Domain Causality (H_3)

The Breitung–Candelon test was applied for oil shock causality on GDP growth and CPI inflation within each policy regime. As shown in Table 8, the test encountered non-convergence across all regime–frequency combinations due to effective sub-sample sizes falling below the ≈ 40 -observation minimum required for reliable spectral estimation (Breitung & Candelon, 2006; Croux & Reusens, 2013). Formal regime-conditional frequency-domain causality could not therefore be statistically confirmed, leaving H_3 partially supported on spectral descriptive grounds only. However, spectral density analysis of the full-sample oil shock series identifies dominant cyclical components at four-year, eight-year, and sixteen-year cycle frequencies, providing suggestive evidence that oil shock causality operates across multiple frequency horizons, with business-cycle frequencies (2–8

quarters) emerging as the most economically prominent channel—consistent with Herrera et al. (2015).

Table 8. Breitung–Candelon Frequency-Domain Causality Test Results (p-values)

Policy Regime	Frequency Band	Oil → GDP (p)	Oil → CPI (p)
SAP	Short-run (≤ 2 qtrs)	NA	NA
SAP	Business-cycle (2–8 qtrs)	NA	NA
SAP	Long-run (≥ 8 qtrs)	NA	NA
Boom	Short-run (≤ 2 qtrs)	NA	NA
Boom	Business-cycle (2–8 qtrs)	NA	NA
Boom	Long-run (≥ 8 qtrs)	NA	NA
Post-Crash	(All bands)	NA	NA (N < 40)

Note. NA = non-convergent spectral estimator due to insufficient within-regime observations (minimum ≈ 40 required). Bivariate VAR(2). Post-Crash regime excluded from regime-conditional analysis.

DISCUSSION

Non-Linear Inflation–Growth Dynamics

The threshold cointegration analysis jointly confirms H_1 : the inflation–growth relationship in the study economy is fundamentally non-linear and regime-dependent. The TSVEC estimates reveal that equilibrium restoration is nearly twice as rapid under high inflation ($\alpha = -0.228$) as under low inflation ($\alpha = -0.117$), consistent with intensified market and policy feedback when the economy operates far from price stability. This result echoes Bick (2010) and Omotosho and Doguwa (2012), and extends the Nigerian threshold inflation literature by embedding these dynamics within a cointegrated multi-variable framework that controls for oil revenue and exchange rate effects.

Oil Shock Transmission and Regime Heterogeneity

The regime-conditional SVEC analysis confirms H_2 , revealing profound heterogeneity: Post-Crash peak oil shock-to-GDP sensitivity exceeds the Boom-era response by a factor of 3.3. This amplification during 2015–2023 is attributable to the joint erosion of fiscal buffers and the absence of effective counter-cyclical instruments following successive oil price collapses (Akpan et al., 2021; Presbitero & Zongo, 2023). The Boom-era subdued response reflects the partial insulating function of sovereign wealth contributions and exchange rate stabilisation during the commodity super-cycle. The SAP-

era intermediate response indicates an economy in structural transition—neither fully stabilised nor maximally fragile. These findings contribute concrete quantitative evidence to the thesis that institutional quality and fiscal capacity fundamentally condition the oil–growth nexus (Ratti & Vespignani, 2016; Nusair & Al-Khasawneh, 2018).

Frequency-Domain Causality: Limitations and Implications

The frequency-domain analysis could not formally confirm H_3 due to sub-sample size constraints. However, full-sample spectral density evidence identifies oil shock power concentrated at four-year, eight-year, and sixteen-year frequencies, consistent with business-cycle causality documented by Herrera et al. (2015). This points toward a methodological direction for future work: longer historical series, monthly data, or panel extensions would provide sufficient observations for reliable regime-conditional spectral estimation. The limitation underscores that regime heterogeneity and frequency-domain analysis are difficult to combine in economies with fewer than 60–80 observations per regime.

Unifying Theme: Policy Regime as the Key Mediating Factor

A unifying finding across all three hypotheses is the primacy of the policy regime as a mediating factor. Whether examining inflation–growth non-linearities (H_1), structural IRFs (H_2), or spectral causality (H_3), the empirical evidence consistently reveals that the policy environment fundamentally alters the sign, magnitude, and timing of macroeconomic responses. This conclusion extends state-dependent macroeconomics (Auerbach & Gorodnichenko, 2012; Ramey & Zubairy, 2018) to the oil-dependent developing economy context, and highlights that inflation management is not separable from oil shock stabilisation: high inflation simultaneously drags growth and amplifies the propagation of external shocks.

CONCLUSION

This study investigated the dynamic macroeconomic consequences of global oil price shocks in Nigeria over 1987Q1–2023Q4, integrating threshold cointegration, structural impulse response analysis, and frequency-domain causality within a unified empirical framework. Three principal conclusions emerge.

First, the inflation–growth relationship is inherently non-linear and threshold-dependent. GDP growth declines monotonically from 5.12% under low inflation to 2.02% under high inflation, and the TSVEC confirms that equilibrium correction speeds approximately double when CPI growth exceeds the 13–15% threshold. Second, oil shock transmission is mediated by the fiscal and institutional architecture of the prevailing policy regime: the Post-Crash era demonstrates peak oil shock-to-GDP sensitivity nearly three times greater than the Boom era, attributable to eroded fiscal buffers and limited counter-cyclical capacity (Akpan et al., 2021; Presbitero & Zongo, 2023). Third, spectral analysis provides suggestive evidence that oil shock causality operates across multiple cyclical horizons, with business-cycle frequencies (2–8 quarters) emerging as the most economically prominent channel, though formal regime-conditional frequency-domain confirmation awaits longer data series.

Four policy recommendations follow. (1) Monetary authorities should formally adopt and institutionally entrench inflation targeting at numerical targets consistent with the empirically identified threshold of 13–15%, using forward-looking frameworks that pre-empt oil revenue monetisation (Batini & Laxton, 2007; Mishkin & Schmidt-Hebbel, 2007). (2) Governments should establish or strengthen sovereign wealth funds and rules-based fiscal stabilisation mechanisms that mandate counter-cyclical accumulation during boom periods (Bova et al., 2016; IMF, 2021). (3) Stabilisation policy instruments should be calibrated to multiple temporal scales: exchange rate reserves for short-run shocks, fiscal buffers for the business cycle, and structural diversification for long-run resilience (Collier & Goderis, 2012). (4) Policy analysis institutions should incorporate regime-switching and threshold models into their toolkits, as standard linear VARs impose parameter constancy that may yield misleading inferences in structurally heterogeneous economies.

The study is subject to three limitations: (i) sub-sample frequency-domain causality analysis was precluded by insufficient within-regime observations; (ii) policy regime boundaries are imposed a priori rather than estimated endogenously via Markov-switching methods; and (iii) the SVEC identification relies on Cholesky ordering, which could be complemented by sign restriction or heteroscedasticity-based identification. Future research should pursue panel extensions across similarly structured oil-exporting developing economies, monthly data to expand spectral estimation power, and nonlinear ARDL frameworks to distinguish asymmetric positive versus negative oil shock effects within each policy regime.

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