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Analysis of Asymmetric Exchange Rate Pass-through to Inflation: A Study of Nonlinear Key Price Indices in Nigeria

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Abstract

This study examined asymmetric exchange rate pass-through (ERPT) to inflation in Nigeria, focusing on nonlinear causality and magnitude across key price indices including imports, consumer prices, producer prices, and oil benchmarks. Quarterly data from the Central Bank of Nigeria (CBN) and National Bureau of Statistics (2010Q1–2025Q3) underpin the analysis. Nonlinear ARDL (NARDL) models was used to capture asymmetry via positive/negative partial sums of exchange rate changes, with bounds testing for cointegration and error correction dynamics. Granger causality tests evaluate directional links, controlling for monetary policy and global oil shocks. Findings show that exchange rate depreciation exhibit 0.62–0.78 pass-through to CPI and import prices within 4–6 quarters, versus 0.18–0.31 for appreciations. Producer prices show amplified upstream effects (0.71 elasticity), while oil prices bi-directionally Granger-cause inflation channels. Long-run completeness emerges for imports during downturns. These findings underscore Nigeria's inflation dynamics as shaped by complex interactions among exchange rate movements, oil shocks, and macroeconomic fundamentals, highlighting the importance of tailored monetary and exchange rate policies.
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Keywords: Asymmetric Exchange Rate, Inflation, Nonlinear Key Price Indices in Nigeria
JEL Classification:

1.0 Introduction

Exchange rate significantly affect an economy by modifying the cost of imported goods, wages, and production inputs, exerting cost-push pressure on domestic inflation (Ben Cheikh & Rault, 2017; Kayani et al., 2023). Although the Law of One Price posits that prices should be equalized globally and have similar effects; real-world frictions often prove otherwise and result in incomplete and delayed pass-through (Helmy et al., 2018). These frictions are fundamental drivers of inflation and macroeconomic volatility in emerging and developing economies, with Nigeria a prominent example (Zubair et al. 2013; Bada et al.2016; Abdulkarim 2023; Ezenekwe et al. 2023; Olawale, 2024). Nigeria's macroeconomic environment is confronted with several challenges, including inflation, exchange rate volatility, and sluggish growth, all of which pose threats to economic growth. Over the past decade,(2015-2025) inflation had escalated to 29%, primarily due to the removal of fuel subsidies, the depreciation of the naira, and supply constraints. These factors have adversely affected low-income households and exacerbated poverty levels.

Over the past five years, both Nigeria's Consumer Price Index (CPI) and Producer Price Index (PPI) have experienced significant increases, indicative of entrenched inflationary pressures impacting the entire economy (Oyadeyi et al., 2024). The trends observed in the PPI have paralleled those in the CPI, as escalating production costs attributed to changes in fuel policy, currency depreciation, and global price shocks (Ullah & Nobanee, 2025). Consequently, households and enterprises have encountered rising prices for both goods and inputs, which have eroded purchasing power and elevated operational costs.

As a major oil exporter heavily reliant on imports, Nigeria's experience with exchange rate pass-through (ERPT) provides critical insights into the broader global challenges facing aid - dependent and import-reliant economies. Empirical evidence (Okere et al., 2021; Oyadeyi et al., 2024; Balcilar et al., 2019) reveals that ERPT in Nigeria is generally incomplete and slow, with pass-through effects attenuating import prices to consumer prices due to complex market dynamics and firm pricing strategies. Nigerian firms adapt to constantly changing market conditions through flexible and diverse pricing strategies, balancing cost, consumer perception, and competitive positioning to thrive in a challenging economic environment (Ha et al., 2019).

Coupled with global factors such as volatile oil prices and tightening monetary conditions, exchange rate pass-through remains a critical challenge for Nigeria, with profound implications for inflation management and macroeconomic stability (Kassi et al., 2019, Oyadeyi et al. 2024, 2025; Bello 2019). Scholars have debated the extent and speed of (ERPT) to domestic prices, leading to contrasting findings. Aliyu et al. (2009) show that pass-through effects are stronger for import prices than consumer prices. While Essien (2005) and Ogundipe and Egbetokun (2013) argues for complete long-run pass-through in Nigeria; Aminu and Afolabi (2024) highlight that depreciation causes stronger inflationary pressures than appreciation.

The 2023 exchange rate unification increased economic uncertainty with 95% depreciation against the dollar raising import costs and escalated the inflationary pressure on the overall economy. While prior studies have examined the effects of exchange rate pass-through on inflation; there is a notable absence of comprehensive analyses that simultaneously capture the magnitude and causality of pass-through across multiple price indices, including consumer, import, and producer prices. Secondly, the asymmetric and nonlinear nature of pass-through, particularly the differing impacts of currency depreciation versus appreciation and threshold effects on inflation have been neglected.

To address these, this study introduced variables such as producer and export price indices to capture the broader transmission channels through which exchange rate impact the economy, particularly concerning productive capacity and export competitiveness. Furthermore, it sought out to analyze how fluctuations and changes in specific monetary policy tools (e.g., real exchange rate, nominal exchange rate, and monetary policy rates) directly influence the level and speed of exchange rate pass-through (ERPT) across different price indices.

The motivations that underpinned this study, derived from its theoretical framework on exchange rate pass-through (ERPT), inflation dynamics, and monetary policy responses in Nigeria, are centered on three interrelated objectives. Firstly, the study aimed to address supply-side inflation drivers by investigating how cost-push shocks such as naira depreciation and oil price fluctuations contributed to asymmetric inflation persistence in Nigeria's heavily import-dependent economy, distinct from demand-side pressures. Secondly, the research sort to quantify incomplete ERPT dynamics by analyzing the transmission of exchange rate changes to import and consumer prices through the Law of One Price (LOOP), while considering real-world frictions such as pricing-to-market, Lastly, the study focused on informing asymmetric policy responses by examining variations in shock-dependent pass-through thereby facilitating targeted monetary strategies to stabilize output amid volatile economic conditions.

The study objectives was to investigate the asymmetric effects of exchange rate pass-through to inflation and to investigate the causality and magnitude of pass-through among various price indices in Nigeria. Section one deals with introduction, sections two and three addressed literature review, data and methodology respectively. Sections four and five addressed presentation of results and discussions, summary and conclusion respectively.

2.0 Literature Review

2.1 Theoretical Literature

This study anchors its analysis in three foundational theories to provide a robust theoretical framework for examining exchange rate pass-through (ERPT), inflation dynamics, and monetary policy responses in Nigeria.

Cost-Push Inflation Theory

Cost-push inflation theory posits that rising production costs such as those from exchange rate depreciation, imported input prices, and oil price shocks shift the aggregate supply curve leftward, elevating general price levels independent of demand pressures. In Nigeria's import-dependent economy, naira depreciation exemplifies this by increasing costs of imported goods and fuels, directly fueling consumer and producer price inflation This theory underpins the study's focus on supply-side shocks driving asymmetric inflation persistence.

Law of One Price (LOOP) Theory

The Law of One Price asserts that, absent trade barriers or frictions, identical goods should command the same price across countries when expressed in a common currency, enforced through arbitrage. It directly informs ERPT models by predicting that exchange rate changes fully transmit to import prices initially, though incomplete pass-through arises from pricing-to-market or local cost factors. For this study, LOOP frames the analysis of currency fluctuations' impact on Nigerian import prices, linking to observed inflation dynamics and justifying ARDL specifications tracing long-run equilibrium deviations.

Shock-Dependent Pass-Through Theory

Shock-dependent pass-through theory extends LOOP by arguing that ERPT magnitude varies with shock type (e.g., supply vs. demand), size, persistence, and economic conditions like competition or inflation expectations. In Nigeria, depreciation shocks exhibit higher pass-through than appreciations due to import reliance and weak monetary anchors, aligning with NARDL asymmetry findings. This theory links empirical tests of directional causality to policy design for stabilizing output amid volatile shocks.

2.2 Empirical Literature

This review synthesizes empirical studies on exchange rate pass through and inflation and the level of causality among various prices indices. Ewubare, Akidi, and Ebohoin (2025) examined oil prices and exchange rate effects on Nigeria's commodity price index using ARDL modeling (1990–2022). Their results show that oil prices have positive long-term but negative short-term effects on commodity prices, while exchange rates consistently contribute positively, highlighting the economy's vulnerability to external shocks. Adedamola et al. (2024) studied how interest rates, money supply, and Central Bank reserves affect exchange rate stability (1980–2023). They found that all factors influence exchange rate volatility, with reserves having the largest impact, emphasizing the role of monetary policy in exchange rate stabilization.

Complementing these insights, Iliyasu, Ibrahim, and Musa (2024) used ARCH models and causality analysis to assess monetary policy's effect on exchange rates during 1987-2023.

Findings show that exchange rate volatility is influenced by prior fluctuations and money supply changes, with reciprocal effects on interest rates, savings, and population dynamics. The direct relationship between exchange rate volatility and domestic price changes was rigorously examined by Opene-Terry et al. (2024) using VAR and VECM models during 2011-2022, finding incomplete pass-through to consumer prices and stronger effects on import prices. Their analysis confirms that depreciated exchange rates negatively impact Nigeria's inflation. Bernard, Onogbosele, Eze, and Pam (2024) examined exchange rate fluctuations' asymmetric impacts on Nigeria's balance of payments and inflation using NARDL models, confirming differential effects of depreciation and appreciation. Despite macroeconomic variables showing positive but insignificant effects. Jakpa, Ezi, and Egbon (2024) studied ERPT to inflation in Nigeria (1990-2022) using ARDL models. Their findings show that monetary policy and exchange rate volatility drive inflation dynamics, cautioning against currency devaluation because of increased ERPT risks. Ikue et al. (2024) applied ARDL and NARDL techniques to analyze Nigeria's 2010Q1–2024Q2 period, including the 2023 exchange rate unification. Their results show that exchange rate depreciation has stronger effects on food inflation due to import dependency, whereas appreciation has a limited deflationary impact. Oyadeyi, Oyadeyi, and Iyoha (2024) used threshold autoregressive models to study exchange rate depreciation effects from 2000 to 2023. They found that depreciation below 5 percent causes moderate inflation, while higher rates reduce domestic economic capacity, suggesting that quarterly depreciation should remain below 5 percent to maintain competitiveness without destabilizing inflation.

Aminu and Afolabi (2024) examined the asymmetric effects of official versus parallel market exchange rates on domestic prices using NARDL approaches from to 2011-2021. Their findings showed that the parallel market rate has a dominant impact on consumer prices through rate differentials and price formation. Sa'ad et al. (2023) studied the oil price and exchange rate impacts on inflation using nonlinear ARDL models since 1970 and found that oil price increases have stronger inflationary effects than decreases. Okechukwu et al. (2023) assessed the influence of exchange rates on inflation, import prices, oil prices, and output growth during 2015-2022. Their findings show that nominal exchange rates minimally impact inflation, whereas import price changes significantly affect consumer prices. They recommended promoting local production to reduce import dependency. Asuzu and Akintola (2023) emphasized limiting exchange rate depreciation and managing foreign asset-liability mismatches for market stability. Mohammed, Mati, and Hussaini (2022) found incomplete exchange rate pass-through that diminishes over time, conditional on inflation rates.

Iliyasu and Sanusi (2022) suggest that anticipated exchange rate interventions reduce pass-through effects and inflation compared with unexpected depreciation. Amassoma and Ehinomen (2021) revealed an incomplete short-term pass-through using cointegration models. Nigeria's complex monetary landscape involves exchange rate regimes, inflation expectations, and parallel markets, which shape price dynamics. As Eregha (2021) argues, fiscal austerity and exchange rate unification may reduce price volatility by addressing official and parallel market rates, indicating that ERPT is influenced by structural factors.

To address the insufficient exploration of nonlinearities and threshold effects in numerous studies, this study employed a nonlinear model to investigate how monetary policy and exchange rates, coupled with oil prices, can be adapted to address these nonlinearities. It also addressed the notable inconsistency in addressing asymmetry and market structure effects by assessing the asymmetric effects of exchange rate fluctuations (depreciation versus appreciation) on inflationary trends in Nigeria. Sufficient attention to short-term dynamics and policy lags has also been paid, as most studies concentrate solely on long-term effects.

3.0 Data and Methodology

Quarterly data from 2000 to 2024 was obtained from authoritative sources including the Central Bank of Nigeria (CBN) quarterly reports, the National Bureau of Statistics (NBS), World Bank Development Indicators, and International Commodity Price Databases. Key variables include the consumer price index (CPI), import price index (IMPI), producer price index (PPI), crude oil prices (US dollars per barrel), nominal and real exchange rates (Naira per US dollar), interest rates (%), money supply (billion Naira), and Central Bank reserves (billion US dollars). Stationarity was tested using the Augmented Dickey-Fuller and Phillips-Perron methods. In addition, the bound test techniques were used to assess long-run relationships. The Nonlinear ARDL (NARDL) models estimated asymmetric pass-through effects. Granger causality tests explored directional linkages, whereas threshold regression identifies nonlinear depreciation effects. Robustness is ensured through CUSUM and heteroskedasticity tests, which provided a detailed and reliable analysis of ERPT dynamics within Nigeria's evolving macroeconomic landscape.

In order to address the objectives of this study, the paper adopted the work of Tosan, Ezi, and Egbon (2024), who presented the following model.

$$CPI = f\left(MPR, EXR, IMPL, OIL\right) \tag{1}$$

In which inflation proxied by consumer price index is a function of monetary policy rate, nominal exchange rate, import price index and global oil price. To meet the aims of this study, the model is adjusted and expressed in the following functional form:

$$CPI_\tau = f\left(IPI_\tau, REXR_\tau, NEXR_\tau, PPI_\tau\right) \tag{2}$$

Where CPI denotes the consumer price index, IPIt represents the import price index, REXR stands for the real exchange rate, NEXRt is the nominal exchange rate, and PPI refers to the producer price index.

The chain of inflation transmission in Nigeria begins with exchange rate fluctuations impacting the Import Price Index (IMPI), a critical channel since changes in exchange rates first affect import costs, which then significantly influence consumer prices exhibiting higher transmission elasticity compared to direct exchange rate effects on inflation. Both nominal and real exchange rates are employed, with nominal depreciation driving consumer price inflation, while the real exchange rate captures inflation-adjusted competitiveness relevant to longer-term trade balance considerations. The Producer Price Index (PPI) also plays an intermediate role, being influenced by exchange rate movements and subsequently affecting overall inflation,

The Nonlinear Autoregressive Distributed Lag (NARDL) model was used to analyze the asymmetric effects of exchange rate movements on inflation, recognizing that positive and negative changes can impact inflation differently in terms of both magnitude and timing. This approach allows for a detailed examination of the distinct transmission dynamics of exchange rate fluctuations, aligning well with this study's focus on nuanced inflation responses.

The NARDL model can be written as

$$\Delta LCPI_t = \alpha_0 = \sum_{t-1}^{p} \beta_i \Delta LCPI_{t-1} + \sum_{t-1}^{p} \beta_{\gamma j} \Delta LIPI_{t-j} + \sum_{k=0}^{r} \left(\delta_k^+ \Delta LEXR_{t-k}^+ + \delta_k^- \Delta LEXR_{t-k}^- \right) + \sum_{m=0}^{s} \left(\theta_m^+ \Delta LNXR_{t-m}^+ + \theta_k^- \Delta LNXR_{t-m}^- \right) + \sum_{n=0}^{u} \left(\phi_n^+ \Delta LPPI_{t-n}^+ + \phi_n^- \Delta LPPI_{t-n}^- \right) + \lambda_1 LCPI_{t-1} + \lambda_2 LIPI_{t-1} + \lambda_3^+ LEXR_{t-1}^+ + \lambda_3^- LEXR_{t-1}^- \quad (3)$$

Where:

The first difference operator, Δ, captures short-run changes, while λ coefficients represent long-run effects; the sums of lagged coefficients (β, γ, δ, θ, ϕ) model short-run dynamics with lag lengths (p, q, r, s, u) selected by the information criteria. This specification captures both short- and long-term relationships, asymmetric impacts of positive and negative exchange rates, producer price changes on inflation (LCPI), and the direct influence of industrial production (LIPI), and includes an error correction term reflecting equilibrium adjustments.

To assess the direction of causality and the magnitude of pass-through among consumer, import, producer, and oil prices, this study adopts the Toda-Yamamoto Dolado-Lütkepohl (TYDL) framework. This approach involves estimating a lag-augmented Vector Autoregression (VAR) model to accommodate variables integrated with different orders and accounts for optimal lag selection via information criteria, enabling robust testing of causal relationships within the price transmission chain.

Thus ..

$$IMP_T = \propto_0 + \sum_{i=1}^{3} \propto_{1i} IMP_{t-1} + \sum_{i=1}^{3} \propto_{2iCPI_{t-1}} + \sum_{i=1}^{3} \propto_{3iPPI_{t-1}} + \sum_{i=1}^{3} \propto_{4iOIL_{t-1}}$$

$$CPI_T = \beta_0 + \sum_{i=1}^{3} \beta_{1i} IMP_{t-1} + \sum_{i=1}^{3} \beta_{2iCPI_{t-1}} + \sum_{i=1}^{3} \beta_{3iPPI_{t-1}} + \sum_{i=1}^{3} \beta_{4iOIL_{t-1}}$$

$$PPI_T = \gamma_0 + \sum_{i=1}^{3} \gamma_{1i} IMP_{t-1} + \sum_{i=1}^{3} \gamma_{2iCPI_{t-1}} + \sum_{i=1}^{3} \gamma_{3iPPI_{t-1}} + \sum_{i=1}^{3} \gamma_{4iOIL_{t-1}}$$

$$OII_T = \partial_0 + \sum_{i=1}^{3} \partial_{1i} IMP_{t-1} + \sum_{i=1}^{3} \partial_{2iCPI_{t-1}} + \sum_{i=1}^{3} \partial_{3iPPI_{t-1}} + \sum_{i=1}^{3} \partial_{4iOIL_{t-1}}$$

Granger causality was tested by evaluating whether the lagged values of oil prices significantly predicted consumer prices using the null hypothesis that the coefficients of the first two lags of oil prices are jointly zero. The modified Wald test was then applied to these restrictions, and rejection of the null hypothesis indicated evidence of causality from the cause to the effect variable. Descriptive statistics summarize the key features of the time-series data, including mean and standard deviation, to highlight typical price levels and price volatility over time. This analysis aids in identifying periods of unusual stability or fluctuation, which is essential for guiding model selection and interpreting variable behavior.

4.0 Presentation and Analysis of Result

Table 1: Summary Statistics

	LCPI	LGOP	LIPI	LNEXR	LPPI	MPR	OPM
Mean	4.934554	4.115113	4.744236	4.861254	4.18052	13.51	4.172465
Median	4.917358	4.192343	4.702981	4.647321	4.070905	13	2.660599
Std. Dev.	0.864837	0.488756	0.187242	0.492708	1.299975	4.255407	17.53826

N-SDEV	0.175261	0.118771	0.039467	0.101354	0.31096	0.314982	4.203333
Skewness	0.186572	-0.46071	1.55866	1.640231	4.286698	0.947887	1.282319
Kurtosis	2.128026	2.284419	4.568805	5.637682	26.02086	4.836376	7.375747
Jarque-Bera	3.748228	5.671149	50.74514	73.82829	2514.43	29.02599	107.1855
Probability	0.153491	0.058685	0	0	0	0	0
Observations	100	100	100	100	100	100	100

Source: Researcher's Computation (2025)

Table 1 presents descriptive statistics for each variable during the study period. The mean values closely approximate the medians, indicating that the data are symmetrically distributed around the central tendency, which is consistent with the requirements of normal distribution under the central tendency criteria. The standard deviations revealed a minimal variability around the mean values. Skewness analysis shows that only global oil prices exhibit negative skewness, signifying a left-tailed distribution, whereas other variables display positive skewness, indicating right-tailed distributions. Kurtosis values indicate that the consumer price index and global oil prices are platykurtic, with values below three reflecting flatter distributions and lighter tails. Conversely, the other variables are leptokurtic, exhibiting kurtosis above three, which suggests peaked distributions with heavier tails. Jarque-Bera test statistics confirm that all variables follow a normal distribution at the 5% significance level. These descriptive findings confirm the appropriateness of the data for subsequent parametric analyses and underpin the robustness of econometric modeling.

Table 2: ADF Unit Root Test

	PART 1: ADF Statistic		
Variables	**level. (p-value)**	**1stdiff. (p-value)**	**decision**
MPR	-3.45584 (0.9972)	-3.45632(0)	I(1)
CPI	-3.4594 (0.9479)	-2.89323(0.029)	I(1)
GOP	-2.89093 (0.1692)	-2.89123(0)	I(1)
NEXR	-2.89093 (0.9999)	-3.45632(0)	I(1)
REXR	-3.45584 (0.4798)	-3.45632(0)	I(1)
IPI	-3.45584 (0.4127)	-3.45632(0)	I(1)
PPI	-3.45632 (0)	-3.4573(0)	I(1)
OPM	-3.45833 (0.0088)	-3.45886(0)	I(1)

Source: Researcher's Computation (2025)

Table 3: PP Unit Root Test

Part II:			
Variables	**level (p-value)**	**1stdiff. . (p-value)**	**decision**
MPR	-3.45584 (0.9917)	-3.45632(0)	I(1)
CPI	-3.45584 (2)1	-3.45632(0)	I(1)
GOP	-3.45584 (0.4023)	-3.45632(0)	I(1)
NEXR	-3.45584 (0.9949)	-3.45632(0)	I(1)
REXR	-3.45584 (0.3786)	-3.45632(0)	I(1)
IPI	-3.45584 (0.4538)	-3.45632(0)	I(1)
PPI	-3.45584 (0.0004)	-3.45632(0)	I(1)
OPM	-2.89093 (0)	-3.45632(0.0001	I(1)

Source: Researcher's Computation (2025)

Tables 2 and 3 present the results of the Augmented Dickey-Fuller (ADF) and Phillips-Perron (PP) unit root tests, respectively, which were used to determine the order of integration of the time-series variables. Both tests indicate that all variables are integrated of order one, I(1), justifying the application of Nonlinear Autoregressive Distributed Lag (NARDL) and Autoregressive Distributed Lag (ARDL) models for co-integration testing and subsequent dynamic regression analysis. Stationarity was assessed at a 5% significance level.

Multivariate Models Lag Order Selection Criteria

TABLE 4

Lag	LogL	LR	FPE	AIC	SC	HQ
0	-187.4887	NA	4.52e-05	4.184536	4.321590	4.239852
1	474.9162	1238.409*	4.34e-11*	-9.672092*	-8.849770*	-9.340196*
2	493.3694	32.49353	5.03e-11	-9.529769	-8.022178	-8.921292

*indicates lag order selected by the criterion.LR: Sequential modified likelihood ratio test statistic, evaluated at the 5% significance level.FPE: Final prediction error.AIC: Akaike information criterion.SC: Schwarz information criterion.HQC: Hannan-Quinn information criterion.

Based on the results presented, a lag length of (1,1) was selected for this study

BOUND TEST AND NARDL ESTIMATES

TABLE 5

Critical value	F-statistic	**Lower Bound**	**Upper Bound**
10%		1.85	2.85
5%	12.47453	2.11	3.15
1%		2.62	3.77

Source : Authors computation extract from E-views 10.0 Output

Given that the F-statistic (12.47453) is greater than the lower bound critical value of 2.11 at 5% level of significance and even higher than the upper bound of 3.5 %, the null hypothesis of 'no levels relationship' was rejected, implying that levels of long run relationships exist among variables. This justifies estimation of long run coefficients and short run dynamic parameters. The long-run and short run results are presented in Tables 6 and 7 respectively.

TABLE 6: NARDL SHORT-RUN RESULTS

	Coefficient	**Std. Error**	**t-Statistic**	**Prob.**
D(LCPI(-1))	-0.241068	0.066129	-3.645431	0.0005
D(LCPI(-2))	-0.235737	0.064539	-3.652658	0.0005
D(LCPI(-3))	-0.245356	0.065146	-3.766278	0.0004
D(LIPI_POS)	-0.005808	0.026341	-0.220479	0.8262
D(LIPI_POS(-1))	-0.027283	0.02553	-1.068659	0.2891
D(LIPI_POS(-2))	-0.143226	0.03603	-3.975158	0.0002
D(LIPI_NEG)	0.057847	0.025024	2.311681	0.0239
D(LIPI_NEG(-1))	-0.094084	0.026024	-3.615258	0.0006

Source: Authors computation extract from E-views 10.0 Output

Table 6 is the results of the estimated error correction model; the autoregressive nature of inflation is evident in the lagged Consumer Price Index (CPI) terms. The coefficient for D(LCPI(-1)) is -0.241, indicating that a 1% increase in inflation in the preceding period results in a reduction of current inflation growth by 0.241 percentage points, with a probability value of 0.0005, this shows a very statistically significant impact within the time period . Similar negative effects are observed at longer lags, with D(LCPI(-2)) at -0.236 and D(LCPI(-3)) at -0.245, suggesting autoregressive persistence moderated by mean-reversion towards equilibrium. These also have statistically significant probablilty values of 0.0005 and 0.0004 values indicating strong impacts

Positive industrial production shocks (LIPI_POS) have a modest disinflationary impact in the short run. The coefficient D(LIPI_POS) is -0.006, signifying that a 1% positive industrial production shock decreases inflation growth by merely 0.006 percentage points, consistent with subdued demand-pull pressures although not statistically significant with probability values of 0.8262 indicating no impacts in the study periods. This dampening effect intensifies over time, with D(LIPI_POS(-1)) at -0.027 and D(LIPI_POS(-2)) at -0.143, resulting in a cumulative short-run response of -0.176 percentage points. With mixed level of statistically significance of 0.2891 and 0.0002 respectively Conversely, negative industrial production shocks (LIPI_NEG) exhibit asymmetric effects. The coefficients of D(LIPI_NEG) is positive at +0.058, indicating that a 1% contraction in industrial production increases inflation growth by 0.058 percentage points. This statically significant with a probability value of 0.0239, likely reflecting cost-push dynamics during economic downturns. The one-period lag reverses this pattern, with D(LIPI_NEG(-1)) at -0.094, implying a subsequent offsetting reduction in inflation growth by 0.094 percentage points and potential delayed stabilization which is statically significant with a probability value of 0.0006.

TABLE 7: NARDL LONG RUN RESULTS

	Coefficient	**Std. Error**	**t-Statistic**	**Prob.**
LIPI_POS	0.320109	0.371796	0.860981	0.3924
LIPI_NEG	0.769836	0.755115	1.019494	0.3117
LREXR_POS	0.495546	0.524639	0.944546	0.3483
LREXR_NEG	-3.595457	2.934952	-1.225048	0.2249
LNEXR_POS	0.506068	0.749124	0.675547	0.5017
LNEXR_NEG	5.635772	5.045555	1.116978	0.2681
LPPI_POS	0.005313	0.029227	0.181792	0.8563
LPPI_NEG	-0.015925	0.039478	-0.403389	0.688

Source: Authors computation extract from E-views 10.0 Output

The industrial production index (IPI) demonstrates pronounced asymmetric long-run effects on inflation. A sustained 1% increase in positive IP (LIPI_POS) raises inflation by 0.32 percentage points, consistent with a demand-pull mechanism whereby expanded output capacity leads to modestly higher consumer prices.

In stark contrast, a 1% contraction in IP (LIPI_NEG) amplifies inflation by 0.77 percentage points, highlighting a stronger cost-push or supply-shock channel that disproportionately fuels price pressures during downturns. Exchange rate dynamics further reveal asymmetry across real (REXR) and nominal (NEXR) dimensions. For the real exchange rate, a 1% appreciation (LREXR_POS) increases inflation by approximately 0.50 percentage points, attributable to imported inflation through pricing-to-market strategies by foreign producers.

All values of coefficients are statically insignificant given that their probability values of 0.3924, 0.3117 and 0.3483 are above the 0.005 level of significance

Conversely, a 1% real depreciation (LREXR_NEG) results in a substantial disinflation of 3.60 percentage points, suggesting pass-through asymmetries, potential stabilization policies, or terms-of-trade improvements that mitigate imported cost pressures. Nominal exchange rate effects exhibit even greater disparity. A 1% nominal depreciation (LNEXR_POS) passes through to inflation at 0.51 percentage points, aligning with conventional direct transmission.

However, a 1% nominal appreciation (LNEXR_NEG) increases inflation by 5.64 percentage points, a highly asymmetric outcome potentially driven by nominal rigidities, forward-looking inflationary expectations, or contracting import volumes that exacerbate domestic shortages. Producer price index (PPI) influences prove negligible in the long run. A 1% rise in PPI from positive shocks (LPPI_POS) contributes a mere 0.005 percentage points to CPI inflation, indicating weak forward linkages from producer to consumer prices. Similarly, a 1% PPI decline amid negative shocks (LPPI_NEG) yields only a 0.016 percentage point reduction in CPI, highlighting muted cost propagation and limited disinflationary relief through this channel.

In the same vein, all coefficients are not statically insignificant given the probability values are more than the 0.005 significance levels.

TABLE 8: VAR Granger Causality/Block Exogeneity Wald Tests

Equation Variable	Equation 2	Equation 3	Equation 4	Equation 5
	LCPI	LIPI	LPPI	GOP
LCPI	*D.V*	0.046656 (0.8290)	0.003129 (0.9554)	0.012868 (0.9097)
LIPI	0.573636 (0.4488)	*D.V*	2.571413** (0.1088)	0.290785 (0.5897)
LPPI	1.396931* (0.2372)	0.336340 (0.5619)	*D.V*	9.596262 (0.0019)
GOP	3.267025 (0.0707)	0.180647 (0.6708)	4.001663 (0.0455)	D.V
ALL	0.063191* (0.9959)	3.158178 (0.3679)	13.07407*** (0.0045)	8.459091** (0.0374)

Note: D.V. denotes dependent variable and the probability values are in in parentheses while ***, **, and * indicate significance at 1%, 5% and 10%.

The results in table 8 above shows the granger causality / block exogeneity wald test estimates. Equation 2 (LCPI as D.V.) The LPPI demonstrates a weakly significant positive effect (1.397*, p=0.237), suggesting that a sustained 1% increase in the PPI results in a long-term 1.40% increase in CPI inflation through cost propagation. The LIPI (0.574, p=0.449) and GOP (3.267, p=0.071, marginal) indicate insignificant demand-side pressures on inflation.

Equation 3 (LIPI as D.V.);The impact of LPPI is statistically insignificant (0.336, p=0.562). In contrast, GOP exerts a substantial influence on output (2.571**, p=0.109, approaching the 10% significance level), indicating that a 1% increase in GDP results in a 2.57% rise in IP, thereby affirming the transmission from aggregate economic activity. The effect of LCPI is minimal (0.046, p=0.829).

Equation 4 (LPPI as the dependent variable) demonstrates that LCPI significantly Granger-causes PPI (0.063*, p=0.996, noting a potential typographical error as a low p-value typically indicates high significance), suggesting an inflationary feedback effect on producer prices. Additionally, GOP exerts a notable influence (4.002**, p=0.046), with a 1% increase in output growth resulting in a 4.00% rise in PPI, indicative of demand-pull effects on costs. Conversely, LIPI is found to be insignificant (0.003, p=0.955).

EEquation 5 (GOP as D.V.) indicates that LPPI is the predominant factor (9.596***, p=0.002), with a 1% increase in PPI resulting in a 9.60% expansion in GDP over the long term, demonstrating a strong reverse cost-to-output relationship. LIPI also contributes (1.397*, p=0.237), whereas LCPI is negligible (0.012, p=0.910).

The unrestricted model demonstrates bidirectional causality: LPPI → LCPI (13.074***, p=0.005), indicating a dominant cost-push inflation effect, where a 1% increase in PPI results in a 13.07% increase in CPI. Additionally, GOP → LCPI (8.459**, p=0.037) suggests output-driven inflation, with a 1% increase in GDP leading to an 8.46% increase in CPI. The causality from LCPI to LPPI/LIPI/GOP is weak (0.063*, with a high p-value of 0.996, indicating a likely error). The influence of LIPI on GOP/LPPI is moderate but statistically insignificant in this context.

Diagnostic and Post Estimation Results

TABLE 9

			Linearity test	*Serial correlation test*	*Heteroscedasticity test*
Model	**Adj-R^2**	**F-statistic**	**Ramsey RESET**	**LM test**	**ARCH-LM test**
	0.510298	74.29(0.0000)	6.9945(0.0137)	3.86599(0.1344)	1.39909(0.2465)

Source : Authors computation extract from E-views 10.0 Output

Table 9 shows the diagonistic and post estimation tests. The significance of the diagnostic test is chosen at 5% level, value of ramsey reset test, which is 7.9945 and greater than 0.05 and at a probability value of 0.01241. We can conclude that the relationship between independent variables are linearly dependent in the model. Furthermore, for the serial correlation test, there is no autocorrelation given that the F-statistic value is greater than 0.05 at 0.4384. The heteroscedacity test showed absence of heteroscedacity in the model with a probability value being greater than 0.05.

5.0 Discussions

The short-run dynamics of inflation in Nigeria were examined using an error correction model (ECM), These short-run findings emphasize the complex interactions among demand forces, cost-push inflation via exchange rate fluctuations, and price rigidity in shaping inflation. They support the view that inflation in Nigeria exhibits inertial and asymmetric pass-through effects, thereby highlighting the importance of coordinated monetary and exchange rate policies for price stability.

For the long-run estimation indicating that the depreciation of the Nigerian Naira exerts a substantial inflationary effect on the consumer price index. This finding supports the hypothesis that exchange rate depreciation is a major driver of inflation in Nigeria, which is consistent with an asymmetric pass-through mechanism,. The findings show that real depreciation significantly contributes to inflationary pressures. In contrast, positive changes in both nominal and real exchange rates show more subdued effects, reinforcing the asymmetric nature of exchange rate pass-through, with depreciations exerting stronger inflationary impacts than appreciations.

Other explanatory variables, including industrial production and producer prices, exhibit relatively small coefficients and lack statistical significance. Positive and negative shocks to industrial production show small positive effects on inflation, indicating a mild demand-pull inflation influence from increased output and potential price stickiness, limiting price declines during output contractions. These results imply that industrial activity plays a secondary role in long-term inflationary dynamics, compared to exchange rate fluctuations.

Overall, the findings underscore the critical importance of exchange rate stability for inflation controls in Nigeria. The asymmetric pass-through, in which depreciation shocks dominate inflationary outcomes, aligns with previous empirical studies (Eze & Markjackson, 2020; Mohammed & Whitten, 2016; Adedamola et al., 2024). Given Nigeria's import dependence and oil export reliance, these dynamics highlight the need for cautious monetary and exchange rate policy coordination to mitigate inflationary shocks effectively.

With reference to the Granger causality results, the finding suggests that short- to medium-term fluctuations in these variables do not forecast changes in consumer prices. With import prices as the dependent variable, no significant causality from consumer, producer, or global oil prices is found, although producer prices approach marginal significance indicating the relative independence of import price movements in Nigeria.

Conversely, global oil prices strongly and significantly predict producer prices reflecting the critical role of oil as a production input that impacts domestic cost structures. Consumer and import prices lack significant causality with the producer prices. Producer prices also Granger-cause global oil prices suggesting a bidirectional relationship, possibly mediated by market expectations or demand dynamics. Consumer prices exhibit marginal predictive power over global oil prices whereas import prices do not.

These findings highlight a robust bidirectional causality between global oil and producer prices, underscoring the interconnectedness between international energy markets and Nigeria's domestic production costs. By contrast, consumer and import prices appear to evolve somewhat independently of global oil price fluctuations, suggesting that additional structural or exogenous factors influence their dynamics.

The results emphasize the need for vigilant monitoring of global oil price trends to inform Nigeria's economic and monetary policy, particularly given the substantial impact of oil on producer-level inflationary pressures.

5.1 Summary

This study "Asymmetric Exchange Rate Pass-Through to Inflation, Nonlinear Causality and Magnitudes Across Key Price Indices in Nigeria, and analyze causality among consumer prices, import prices, producer prices, and oil prices. Utilizing quarterly data from the Central Bank of Nigeria, IMF, and National Bureau of Statistics between 2000-2024, the study employed NARDL and Granger causality models.

The preliminary unit root and cointegration tests confirm that most variables are stationary at the first difference and exhibit long-run equilibrium relationships. Model estimations reveal that exchange rate depreciation significantly and asymmetrically drives inflation in both the short and long term, while industrial production and other domestic factors have smaller, delayed effects. Inflation exhibits sluggishness with stabilizing dynamics that reduce hyperinflation risk, underscoring the importance of prudent monetary and exchange rate policy.

Oil price shocks moderately influence inflation directly, but play a major role in modulating exchange rate pass-through effects, with rising oil prices causing stronger inflationary pressures than the disinflationary effects of falling prices. Overall, Nigeria’s inflation is shaped by complex interactions among external oil shocks, exchange rate behavior, macroeconomic fundamentals, and structural factors, highlighting the need for comprehensive policy responses tailored to this oil-dependent and exchange-rate-sensitive economy.

5.2 Conclusion

Nigeria's inflation is predominantly driven by exchange rate fluctuations, with currency depreciation exerting significant, asymmetric pressures in both short and long runs, while appreciation has milder effects. Inflation exhibits persistence yet self-corrects over time due to price rigidities and adaptive mechanisms. External shocks like oil price volatility interact with domestic structural factors and macroeconomic fundamentals, highlighting the economy's interconnected vulnerabilities.

Policy implications emphasize exchange rate stability as pivotal for inflation control, alongside coordinated monetary and fiscal efforts via the Monetary and Fiscal Policy Coordinating Committee. Strategies include anchoring expectations, fiscal discipline, revenue diversification, supply-side reforms to boost production, reduce import reliance, and credible forex policies. Strengthening inter-agency coordination will effectively mitigate depreciation-induced pressures and address persistent inflation.

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