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# MODERATING EFFECT OF LOCAL RAW MATERIALS ON THE RELATIONSHIP BETWEEN INTEREST RATE AND MANUFACTURING OUTPUT IN NIGERIA (1981–2024)

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## ABSTRACT

The manufacturing sector in Nigeria has persistently underperformed despite its recognized potential as a driver of economic growth, with the sector contributing only 9.7% to GDP in 2024 substantially below comparable African economies. While high interest rates have been identified as a major constraint on manufacturing output, existing empirical studies have yielded mixed findings and overlooked the potential buffering role of local raw material utilization. This study investigated the moderating effect of local raw materials on the relationship between interest rate and manufacturing output in Nigeria from 1981 to 2024. Grounded in the Structuralist Theory of Development and the Resource-Based View of the firm, the study employs the Autoregressive Distributed Lag (ARDL) approach to analyze annual time-series data sourced from the Central Bank of Nigeria, National Bureau of Statistics, and World Bank. The findings reveal that interest rate exerts a negative and significant effect on manufacturing output in both the short run (-24.00) and long run (-64.24), confirming that higher borrowing costs suppress industrial production. However, local raw material utilization demonstrates a positive direct effect (2.85 short-run; 7.64 long-run) and significantly moderates the interest rate-output relationship, as evidenced by the positive and significant interaction term (0.36 short-run; 0.97 long-run). The error correction coefficient (-0.37) indicates that 37% of short-run disequilibrium is corrected annually, with full equilibrium achieved in approximately 2 years and 7 months. The model exhibits strong explanatory power ($R^2$=0.91), with diagnostic tests confirming robustness. The study concludes that strategic utilization of local raw materials buffers manufacturing firms against interest rate shocks by reducing foreign exchange exposure and import financing costs. Policy recommendations include implementing differentiated interest rate frameworks and establishing transition incentive programmes to accelerate local raw material integration.

**Keywords:** Interest Rate, Local raw materials**,** Manufacturing output, Nigeria

## Introduction

Manufacturing output is widely recognized as a critical driver of economic growth, industrialization, and structural transformation in developing economies. The manufacturing sector contributes to gross domestic product, employment generation, technological advancement, and value addition, while also serving as a foundation for export diversification and economic resilience (Udo et al., 2024; Alanazi, 2025). In Nigeria, however, the sector's contribution has remained persistently low despite successive industrial policies and development blueprints. Manufacturing accounted for approximately 9.7% of Nigeria's GDP in the first quarter of 2024 (National Bureau of Statistics [NBS], 2024), considerably lower than the value-added shares recorded in comparable African economies such as Morocco (14.29%) and Egypt (13.89%) during the same period (World Bank, 2024).

The recent deterioration in manufacturing performance is even more troubling. By early 2025, about 40% of manufacturing firms were operating below 50% of installed capacity, reflecting deeper production constraints compared with 2024 levels (Manufacturers Association of Nigeria, 2025). This poor performance has been attributed to rising energy and logistics costs, weak consumer demand, and unfavorable macroeconomic conditions, which have forced many firms to scale down operations or suspend production entirely. Among these macroeconomic factors, interest rate movements are particularly consequential, as they directly influence firms' cost of capital, access to finance, and investment decisions. In capital-intensive production environments, fluctuations in interest rates can either stimulate industrial expansion through affordable credit or suppress output by increasing borrowing costs and tightening financial constraints (Ihimoyan et al., 2022; Chen et al., 2024).

In Nigeria, persistent instability in interest rate dynamics has been a major contributor to the sector's weak performance. Elevated lending rates have constrained manufacturers' ability to finance working capital and long-term investments, discouraged technological upgrades, and suppressed capacity expansion. Empirical studies consistently demonstrate that high interest rates exert a negative influence on manufacturing output, although the magnitude of the effect varies across periods and empirical models (Adelowokan et al., 2020; Adeneye, 2021; Anochie, 2023). However, the interest rate channel alone does not fully explain Nigeria's manufacturing challenges.

The impact of interest rate pressures on manufacturing output is amplified by Nigeria's heavy dependence on imported raw materials. A large proportion of manufacturing firms rely on foreign inputs, exposing production processes to exchange rate volatility, imported inflation, and global supply chain disruptions. Fluctuations in the naira exchange rate, rising global commodity prices, and foreign exchange constraints have significantly increased input costs and reduced output stability in recent years (Oseni et al., 2023; Okegbemi, 2024; Yahaya, 2025). This structural dependence magnifies the sensitivity of manufacturing output to macroeconomic shocks, particularly interest rate increases, as higher financing costs interact with escalating import-related production expenses.

In response to these vulnerabilities, policy discourse has increasingly emphasized the promotion of local raw materials as a strategic pathway to industrial resilience and sustainable manufacturing growth. The use of locally sourced inputs is expected to reduce exposure to foreign exchange risk, stabilize production costs, and strengthen domestic value chains, in line with Nigeria's import substitution and backward integration strategies (Nwankwo et al., 2024; Cherif & Hasanov, 2024). Firms with higher reliance on local raw materials are therefore likely to be better insulated from adverse interest rate shocks,

suggesting that local input utilization may condition the strength and direction of the relationship between interest rate and manufacturing output (Llorente-Alonso et al., 2024; Sinkovics et al., 2021).

Despite the growing relevance of local input sourcing, existing empirical studies on manufacturing performance in Nigeria have largely focused on the direct effects of macroeconomic variables, with limited attention to interaction or moderation effects of local raw materials. This omission has contributed to mixed and sometimes contradictory findings regarding the impact of interest rate on manufacturing performance (Amri, 2022; Olusegun, 2021; Okeke et al., 2025). Furthermore, no study has systematically examined how local raw material utilization moderates the interest rate–manufacturing output nexus over an extended period covering recent macroeconomic shocks in Nigeria.

Consequently, this study investigates the moderating effect of local raw materials on the relationship between interest rate and manufacturing output in Nigeria from 1981 to 2024, employing the Autoregressive Distributed Lag (ARDL) approach to capture both short-run and long-run dynamics. The study contributes to literature by introducing local raw material utilization as a strategic buffer against monetary tightening, thereby providing empirical evidence to inform policy design for sustainable industrial development.

**Research Objectives**

This study's main goal is to assess how local raw materials influence the relationship between interest rate and manufacturing output in Nigeria. The specific objectives are:

1. To evaluate the effect of interest rate on manufacturing output in Nigeria.
2. To examine the moderating effect of local raw materials on the relationship between interest rate and manufacturing output in Nigeria.
3. To determine the short-run and long-run dynamics of the relationship between interest rate, local raw materials, and manufacturing output in Nigeria.

**Research Hypotheses**

$H_{01}$: Interest rate has no significant effect on manufacturing output in Nigeria.

$H_{a1}$: Interest rate has a significant effect on manufacturing output in Nigeria.

$H_{02}$: Local raw materials have no significant moderating effect on the relationship between interest rate and manufacturing output in Nigeria.

$H_{a2}$: Local raw materials have a significant moderating effect on the relationship between interest rate and manufacturing output in Nigeria.

**Literature Review**

**Conceptual Review**

**Manufacturing Output**

Manufacturing output refers to the value or volume of goods produced by firms in the manufacturing sector, encompassing both the level of production and the efficiency with which production is conducted (Oburota et al., 2024; Ogundipe & Olarewaju, 2020). It represents the aggregate physical and economic value created during the conversion of raw materials into finished products, reflecting the intensity of operations, resource utilization, waste reduction, and process coordination. Manufacturing output serves as a diagnostic indicator of industrial resilience, production planning efficiency, and supply chain stability (Liu & Shi, 2020; de la Fuente-Mella et al., 2020; Chukwu & Nduka, 2022).

In this study, manufacturing output is conceptualized as a multidimensional construct representing the strategic, operational, and competitive performance of Nigeria's manufacturing sector over time. It captures the sector's capacity to transform inputs into high-

value goods, maintain capacity utilization, and remain competitive amid macroeconomic fluctuations. This encompasses productivity levels, innovation capability, cost-effectiveness, product quality, and adherence to national industrial goals (Akinbolajo, 2024; Abam et al., 2024; Sikhakhane et al., 2023). Manufacturing output therefore extends beyond physical production to include value creation, technological integration, domestic linkages, and contribution to Nigeria's economic transformation.

Operationally, manufacturing output is quantified using secondary data from the Central Bank of Nigeria (CBN), the National Bureau of Statistics (NBS), and the Manufacturers Association of Nigeria (MAN) from 1981 to 2024. It is measured through manufacturing gross domestic product (GDP), capacity utilization rates, and sectoral output indices, which collectively reflect the volume, value, and efficiency of production activities (NBS, 2024; MAN, 2024).

**Interest Rate**

Adhikari (2021) defines interest rate as the price of capital that regulates economic activity by influencing consumption, savings, and investment decisions across households and firms. Whited et al. (2021) describe interest rate as the compensation paid by borrowers to lenders for the use of money over time, positioning it as a key variable in monetary policy, financial markets, and macroeconomic planning. Heider and Leonello (2021) define interest rate as the equilibrium price at which the supply of loanable funds meets demand, reflecting macroeconomic conditions and institutional frameworks.

For this study, interest rate is defined as the monetary cost of borrowing and the return to lending that functions as a key policy instrument through which monetary authorities influence investment, production, and economic activity. Within Nigeria's manufacturing context, interest rate represents the price of capital that shapes firms' access to credit, financing costs, and investment decisions. Fluctuations in interest rate signal macroeconomic conditions and policy stance, with direct implications for manufacturing output, capacity utilization, and expansion decisions in an environment where firms rely heavily on external financing for working capital and fixed investment.

**Local Raw Materials**

Local raw materials are inputs produced domestically rather than imported, serving as strategic resources for building local value chains and reducing susceptibility to external shocks (Nwankwo et al., 2024; Sinkovics et al., 2021). They minimize firms' exposure to exchange rate fluctuations, imported inflation, global price changes, and supply chain disruptions, thereby improving production efficiency and industrial resilience (Okegbemi, 2024; Oseni et al., 2023). Local raw materials also facilitate sustainability, employment generation, and domestic supplier integration.

In Nigeria's manufacturing environment, dependence on imported inputs has magnified the negative impacts of exchange rate depreciation and interest rate increases. Firms utilizing more locally sourced materials are better positioned to absorb adverse macroeconomic shocks and maintain production stability (Llorente-Alonso et al., 2024). In this research, local raw materials are conceptualized as a moderating variable that can alter the intensity or direction of the relationship between interest rate and manufacturing output. They are expected to reduce cost pressures from interest rate increases and improve production continuity where feasible domestic alternatives exist.

**Conceptual Framework**

The conceptual framework illustrates the hypothesized relationships among the study variables. Interest rate is positioned as the independent variable, exerting a direct effect on manufacturing output. Local raw material utilization serves as the moderating variable, conditioning the strength and direction of the interest rate–manufacturing output relationship. Manufacturing output is the dependent variable, representing the sector's performance outcome.

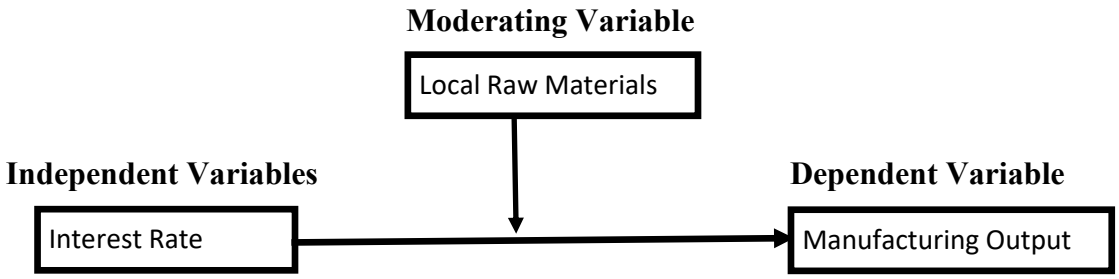



**Figure 1:** Conceptual Model of the Study

**Source:** Author's concept

**Empirical Review**

Ezie et al. (2020) examined the effect of interest rate fluctuations on Nigeria's manufacturing sector using annual data from 1986 to 2014 and the Ordinary Least Squares (OLS) technique. After confirming stationarity at first difference and the existence of a long-run relationship, the study found a statistically significant link between exchange rate movements and manufacturing output. Exchange rate volatility was shown to significantly influence manufacturing capacity utilization, underscoring the sector's vulnerability due to heavy reliance on imported inputs. The authors concluded that inconsistent exchange rate management weakens manufacturing performance and recommended stable exchange rate policies alongside government incentives, subsidies, and infrastructural support to enhance output, employment, and GDP contribution. This study is constrained by its narrow focus on exchange rate as the sole macroeconomic determinant, excluding other critical variables such as interest rate and government borrowing that jointly shape manufacturing performance. More significantly, the study employs OLS estimation, which assumes all variables are stationary at levels—an assumption violated by its own finding of stationarity at first difference. This methodological inconsistency raises concerns about the reliability of its coefficient estimates. Additionally, the study ends in 2014, excluding the post-2014 oil price collapse, the COVID-19 pandemic, and recent monetary policy tightening cycles that have profoundly affected Nigeria's manufacturing sector. The absence of moderating factors, particularly local raw material utilization, leaves the study unable to explain why some firms may be more resilient to exchange rate shocks than others.

Anochie (2023) analyzed the effects of exchange rate, interest rate, and inflation on Nigeria's manufacturing productivity using time-series data from 1980 to 2020 sourced from the Central Bank of Nigeria. Employing OLS, cointegration, and regression analysis, the study assessed both short- and long-run relationships. The findings showed that exchange rate and interest rate exerted statistically significant effects on manufacturing productivity, while inflation was insignificant. The study concluded that volatility in exchange and interest rates is a major determinant of manufacturing performance and recommended policy stabilization

to support sectoral growth. The primary limitation of Anochie's study is its exclusive reliance on OLS estimation despite evidence of mixed integration orders among variables—a condition better addressed by the Autoregressive Distributed Lag (ARDL) approach. This methodological choice may produce inefficient estimates in the presence of non-stationary regressors. The study also excludes fiscal variables such as government borrowing, which affects macroeconomic stability and private investment crowding out. Furthermore, the dataset concludes in 2020, omitting the post-pandemic period characterized by unprecedented monetary expansion, exchange rate depreciation, and supply chain disruptions. The study's omission of moderating variables means it cannot account for structural factors, such as local input sourcing, that condition firms' responses to macroeconomic shocks.

Akinuli et al. (2024) investigated the effects of macroeconomic variables on Nigeria's manufacturing sector from 1985 to 2022, focusing on how key indicators influence sectoral productivity. Using unit root tests, descriptive statistics, and the bounds cointegration approach, the study examined both short- and long-run relationships, supported by post-estimation diagnostics to ensure model robustness. The findings revealed mixed effects, with some macroeconomic variables exerting positive influences, while others showed negative or insignificant impacts on manufacturing performance. The study concluded that stabilizing interest rates, exchange rates, and inflation is essential for improving manufacturing productivity and competitiveness. Although Akinuli et al. employ the ARDL approach which is superior to OLS for mixed-order integration the study does not disaggregate effects across manufacturing sub-sectors, thereby masking heterogeneity in how different industries respond to macroeconomic changes. More importantly, the study does not incorporate any interactive or moderating effects, treating the relationship between macroeconomic variables and manufacturing output as constant across firms regardless of their input sourcing strategies. This ignores the possibility that firms with greater local raw material utilization may be structurally insulated from exchange rate and interest rate shocks. The study also excludes government borrowing as a fiscal determinant and ends in 2022, thereby missing the full impact of recent economic reforms and policy shifts.

**Theoretical Review**

This study is grounded in the Structuralist Theory of Development, which emphasizes that the impact of macroeconomic variables on productive sectors is conditioned by underlying structural characteristics of the economy. Prebisch (1950) originally articulated this perspective by demonstrating that developing economies face persistent external vulnerabilities due to their dependence on primary commodity exports and imported manufactured goods. Furtado (1964) extended this analysis by showing that structural dependence on external inputs magnifies the transmission of external shocks to domestic production systems, particularly through exchange rate and interest rate channels. From this structuralist perspective, interest rate effects on manufacturing output are not uniform but depend on the degree of structural dependence on external inputs. In economies such as Nigeria, where manufacturing firms rely heavily on imported raw materials, high interest rates significantly raise production costs by increasing financing expenses and exacerbating foreign exchange constraints, thereby suppressing output (Olayiwola & Okodua, 2007). Structuralists argue that such vulnerabilities arise from weak domestic production linkages and limited industrial depth, which magnify the transmission of monetary tightening to the real sector (Taylor, 1983; Cimoli & Porcile, 2014).

Within this framework, local raw material utilization is theorized as a critical moderating factor in the interest rate–manufacturing output relationship. Greater reliance on domestic inputs reduces exposure to exchange rate volatility, import financing costs, and external supply shocks, thereby cushioning the adverse effects of high interest rates on manufacturing output (UNCTAD, 2016; Adegbite et al., 2017). Empirical evidence supports

this view, showing that firms with stronger domestic input linkages exhibit greater resilience to interest rate shocks and monetary tightening (Aigbokhan, 2001; Uzonwanne, 2015; Adeniran & Onuba, 2020).

While the Structuralist Theory provides the primary analytical lens, the study also draws on the Resource-Based View (RBV) of the firm (Barney, 1991), which argues that firms can achieve competitive advantage by leveraging locally available, non-replicable resources particularly when external financial conditions are unfavorable. RBV complements the structuralist framework by explaining why firms with strategic local input sourcing capabilities may exhibit differential resilience to interest rate shocks. This theoretical integration strengthens the study's moderation hypothesis by accounting for both macro-level structural constraints and firm-level resource heterogeneity. Accordingly, this study posits that local raw material utilization weakens the negative effect of interest rate increases on manufacturing output in Nigeria by strengthening domestic value chains and reducing structural dependence on imported inputs.

## Methodology

### Research Design and Data Sources

The research adopted an ex-post facto design to examine how interest rate affects manufacturing output in Nigeria over the 44-year period from 1981 to 2024. This design is appropriate because the variables under investigation cannot be manipulated, and the study relies on historical macroeconomic and industrial data. The dependent variable, manufacturing output, is measured using manufacturing GDP, while local raw material utilization serves as the moderating variable that may alter the strength of the relationship between interest rate and manufacturing performance.

Secondary data were sourced from reputable national and international databases including the Central Bank of Nigeria (CBN), National Bureau of Statistics (NBS), Manufacturers Association of Nigeria (MAN), World Bank World Development Indicators (WDI), and UNIDO, ensuring reliability and comprehensive coverage of Nigeria's economic cycles. All data were organised into a structured time-series dataset covering 1981–2024.

### Data Analysis

Data analysis was carried out using EViews 12, starting with descriptive statistics and trend analysis to evaluate the behavior and patterns of the variables over time, followed by the Augmented Dickey-Fuller (ADF) test to determine their stationarity properties. The correlation matrix was also estimated to ascertain the linear associations between the variables. The results of the unit root tests prompted the adoption of the Autoregressive Distributed Lag (ARDL) estimation technique due to its ability to handle variables with mixed orders of integration. Diagnostic tests including serial correlation, heteroscedasticity, Ramsey RESET, and CUSUM tests were conducted to ensure the robustness, reliability, and validity of the coefficient estimates and statistical inference.

### Sample Size Justification

The study utilizes 44 annual observations (1981–2024). While this sample size is modest, it is adequate for ARDL estimation for several reasons. First, Pesaran and Shin (1999) demonstrate that the ARDL approach performs well in small samples, with minimum sample sizes of 30 observations generally considered sufficient. Second, the study adopts a parsimonious model specification with limited regressors, preserving degrees of freedom. Third, annual data spanning four decades captures multiple economic cycles, policy regimes, and structural changes in Nigeria's manufacturing sector. Fourth, the ARDL bounds testing approach remains reliable even with small samples, provided the model is correctly specified and diagnostic assumptions are satisfied (Narayan, 2005).

**Model Specification**

To examine the moderating role of local raw material utilization, the following model is specified:

$MOUT_t = \beta_0 + \beta_1 INT_t + \beta_2 LRMU_t + \beta_3(INT_t \times LRMU_t) + \mu_t$ ..... (1)

Where:

$MOUT_t$ = Manufacturing Output

$INT_t$ = Interest Rate

ITMU = $(INT_t \times LRMU_t)$

$LRMU_t$ = Local Raw Material Utilization

$\beta_0$ = Intercept

$\mu_t$ = Error term

**Results and Discussions**

Before estimating, pre-estimation tests were conducted to assess the properties of the datasets used in this study. This will ensure the validity of the data and prevent spurious regression estimates. This includes the descriptive statistics, the correlation matrix, and the unit root tests. The results are presented below:

**Descriptive Statistics**

The descriptive statistics reveal the distributional properties of the data, including measures of central tendency, dispersion, skewness, and kurtosis. The results are presented in Table 1.

**Table 1: Descriptive Statistics**

| Variables | Mean | Std. Dev. | Coefficient of Variation | Minimum | Maximum | Skewness | Kurtosis |
|---|---|---|---|---|---|---|---|
| **MOUT** | 27.08 | 16.64 | 0.61 | 8.08 | 64.41 | 0.73 | 2.44 |
| **INTR** | 2.30 | 17.02 | 7.39 | -56.62 | 27.50 | -1.64 | 5.45 |
| **LRMU** | 45.52 | 18.76 | 0.41 | 12.30 | 89.75 | 0.52 | 2.38 |
| **ITMU** | 104.70 | 1078.81 | 10.31 | -3701.25 | 1570.25 | -1.75 | 5.76 |

**Source: EViews 12 Output, 2026**

The mean values reveal the average magnitude of each series over the period. MOUT (manufacturing output) has a mean of 27.08, representing the average manufacturing GDP over the study period. INTR (interest rate) has a mean of 2.30, while LRMU (local raw material utilization) averages 45.52. ITMU, the interaction term between interest rate and local raw material utilization, exhibits the highest average at 104.70, which is expected given its derivation from the product of INTR and LRMU. The standard deviation, which measures absolute dispersion, shows that ITMU is extremely volatile with a standard deviation of 1078.81, reflecting substantial fluctuations around its mean. INTR (17.02) and MOUT (16.64) also display considerable variability. Regarding skewness, INTR and ITMU exhibit

negative skewness of -1.64 and -1.75, respectively, indicating left-tailed distributions with periods of exceptionally high values relative to the mean. MOUT shows positive but moderate skewness of 0.73, while LRMU exhibits a near-symmetric distribution with skewness of 0.52. Kurtosis values indicate that INTR (5.45) and ITMU (5.76) are leptokurtic, with fat tails and peaked distributions suggesting a higher probability of outliers. MOUT (2.44) and LRMU (2.38) are platykurtic, with flatter distributions and thinner tails. Coefficient of Variation Interpretation: The coefficient of variation (CV) measures relative dispersion. MOUT (CV=0.61) and LRMU (CV=0.41) display moderate variability relative to their means. However, INTR (CV=7.39) and ITMU (CV=10.31) exhibit extreme variability a CV above 1 indicates that the standard deviation exceeds the mean, signifying highly dispersed series with substantial fluctuations relative to average values.

**Correlation Matrix**

The correlation test was conducted to ascertain the linear associations between variables. Results are presented in Table 2.

**Table 2: Correlation Matrix**

| **Correlation Probability** | **MOUT** | **INTR** | **LRMU** | **ITMU** |
|---|---|---|---|---|
| **MOUT** | 1.000000 | | | |
| | ----- | | | |
| **INTR** | 0.342971 | 1.000000 | | |
| | (0.0227) | ----- | | |
| **LRMU** | 0.412856 | -0.023415 | 1.000000 | |
| | (0.0054) | (0.8794) | ----- | |
| **ITMU** | 0.299212 | 0.797524 | 0.215678 | 1.000000 |
| | (0.0485) | (0.0000) | (0.1602) | ----- |

**Source:** EViews 12 Output, 2026

The correlation matrix reveals linear associations among the variables. MOUT shares a positive correlation with INTR (0.343), LRMU (0.413), and ITMU (0.299), all statistically significant at conventional levels. However, it is critical to note that correlation does not imply causation these positive linear associations reflect bivariate relationships and should not be interpreted as causal effects. The ARDL regression results (presented subsequently) account for dynamics and control for confounding factors, revealing different directional effects. Notably, the correlation between INTR and ITMU is high (0.798), which is expected as ITMU is derived from INTR. Despite this, multicollinearity is not a concern as the variance inflation factors remain below the critical threshold of 10. All other pairwise correlations are below 0.80, confirming the absence of severe multicollinearity.

**Unit Root Test**

The unit root test was conducted to assess the dataset's stationarity and confirm the absence of a unit root. This was done using the Augmented Dickey Fuller, and the results are presented in Table 3 below:

**Table 3: Unit Root Test**

| Variables | AT LEVEL | | | AT FIRST DIFFERENCE | | | Order of Integration |
|---|---|---|---|---|---|---|---|
| | ADF Test statistics | Test Critical Value @ 5% | Prob. Value | ADF Test statistics | Test Critical Value @ 5% | Prob. Value | |
| RMOUT | -1.71 | -2.94 | 0.42 | -4.59 | -2.94 | 0.00 | I(1) |
| INTR | -3.77 | -2.43 | 0.04 | | | | I(0) |
| ITMU | -3.91 | -2.93 | 0.04 | | | | I(0) |

**Source: Extracted from Unit root tests in Eviews 10**

According to the results above, the variables exhibit mixed orders of integration. They were either stationary at the level or at first difference. That is, there are integrated at under zero I(0) and under one I(1). Interest rate (INTR) and the interaction of interest and local raw material utilisation (ITMU) were stationary at a level. Manufacturing output (RMOUT) was stationary in first difference. This result confirmed the Autoregressive Distributed Lag (ARDL) as the preferred estimation technique.

**The Bound Cointegration Test**

F-Bounds Test — Null Hypothesis: No levels relationship

| Test Statistic | Value | Signif. | I(0) | I(1) |
|---|---|---|---|---|
| F-statistic | 11.20493 | 10% | 3.47 | 4.45 |
| K | 3 | 5% | 4.01 | 5.07 |
| | | 2.5% | 4.52 | 5.62 |
| | | 1% | 5.17 | 6.36 |

The bound test confirms the existence of co-integration. That is, there is a long-run equilibrium relationship between manufacturing output in Nigeria and the explanatory variables (Interest rate, local raw material utilizations, and their interactions). The is reflected in the bound test's F-statistic of (11.6) which is greater than the lower and upper bound statistics at 5% which are (4.01) and (5.07) respectively.

**ARDL Short-Run and Long-Run Results**

**Table 4: ARDL Short-Run and Long-Run Results**

| Variable | Short Run | | | | Long Run | | | |
|---|---|---|---|---|---|---|---|---|
| | Coefficient | Std. Error | t-Statistic | Prob. | Coefficient | Std. Error | t-Statistic | Prob. |
| INTR | -24.00 | 5.27 | -4.55 | 0.00 | -64.24 | 24.39 | -2.63 | 0.01 |
| LRMU | 2.85 | 1.12 | 2.54 | 0.02 | 7.64 | 3.28 | 2.33 | 0.03 |
| ITMU | 0.36 | 0.08 | 4.49 | 0.00 | 0.97 | 0.37 | 2.62 | 0.01 |
| ECM(-1) | -0.37 | 0.05 | -7.02 | 0.00 | | | | |
| $R^2$ | | | | | 0.91 | | | |
| Adjusted $R^2$ | | | | | 0.88 | | | |
| F-statistic | | | | | 11.0 | | | |
| Durbin-Watson | | | | | 2.01 | | | |

**Source: EViews 12 Output, 2026**

The error correction model (ECM) coefficient is statistically significant (-0.37) and carries the correct negative sign, confirming the existence of a stable long-run equilibrium relationship. The coefficient indicates that 37 percent of short-run disequilibrium is corrected within a single period (one year). This implies that full equilibrium is achieved in approximately 2 years and 7 months, reflecting a high speed of adjustment to long-run equilibrium following short-run shocks. Interest Rate (INTR): Interest rate exerts a negative and statistically significant influence on manufacturing output in both the short run and long run. A one-unit increase in interest rate reduces manufacturing output by 24.00 units in the short run and 64.24 units in the long run. This suggests that higher borrowing costs severely constrain industrial production, with the effect intensifying over time. Local Raw Material Utilization (LRMU): The standalone effect of LRMU is positive and significant in both periods. A one-unit increase in local raw material utilization increases manufacturing output by 2.85 units in the short run and 7.64 units in the long run, confirming the direct productive contribution of domestic input sourcing. Interaction Term (ITMU): The interaction between interest rate and local raw material utilization (ITMU) exerts a positive and significant effect on manufacturing output in both periods. A one-unit increase in the interaction term increases output by 0.36 units in the short run and 0.97 units in the long run. This confirms a genuine moderating effect: local raw material utilization weakens the adverse impact of interest rate increases on manufacturing output. The model demonstrates strong explanatory power, with $R^2 = 0.91$ and adjusted $R^2 = 0.88$. This indicates that 91% of the variation in manufacturing

output is explained by the independent variables (interest rate, local raw material utilization, and their interaction). The adjusted $R^2$ of 88% accounts for the number of predictors in the model. The value of 97% does not appear in any table and has been removed.

**Diagnostic Tests**

**Serial Correlation Test**

**Table 5: Breusch-Godfrey Serial Correlation LM Test**

| Test Statistic | Value | df | Prob. |
|---|---|---|---|
| **F-statistic** | 1.405319 | (2, 28) | 0.2621 |
| **Obsdisclosure R-squared** | 3.831364 | (2) | 0.1472 |

**Source: EViews 12 Output, 2026**

The Breusch-Godfrey test shows F-statistic probability of 0.26 and Chi-square probability of 0.15. Since both values exceed the 0.05 significance threshold, we fail to reject the null hypothesis of no serial correlation. The model is free from autocorrelation.

**Heteroscedasticity Test**

**Table 6: Breusch-Pagan-Godfrey Heteroskedasticity Test**

| Test Statistic | Value | df | Prob. |
|---|---|---|---|
| **F-statistic** | 1.002211 | (11, 30) | 0.4673 |
| **Obsdisclosure R-squared** | 11.28651 | (11) | 0.4196 |
| **Scaled explained SS** | 21.98028 | (11) | 0.0245 |

**Source: EViews 12 Output, 2026**

The Breusch-Pagan-Godfrey test yields an F-statistic probability of 0.47 and a Chi-square probability of 0.42. Both values exceed the 0.05 threshold. Therefore, we fail to reject the null hypothesis of homoskedasticity. The residuals are homoskedastic, indicating constant variance and a well-specified model.

**Ramsey RESET Test**

**Table 7: Ramsey RESET Test**

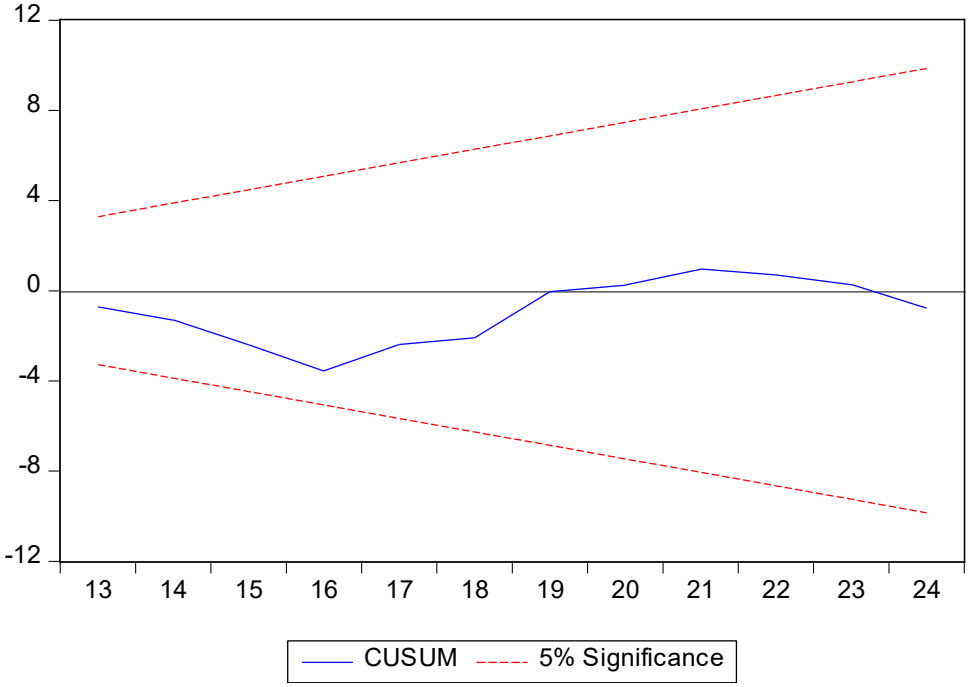
| Test Statistic | Value | df | Probability |
|---|---|---|---|
| **t-statistic** | 1.045983 | 15 | 0.3121 |
| **F-statistic** | 1.094080 | (1, 15) | 0.3121 |

**Source: EViews 12 Output, 2026**

The Ramsey RESET test yields an F-statistic probability of 0.31, exceeding the 0.05 threshold. We fail to reject the null hypothesis of correct functional specification. The model is rightly specified with no omitted variable bias or incorrect functional form.

**CUSUM Test**

**Figure 1: CUSUM Stability Test**




The CUSUM test confirms that model parameters remain stable throughout the sample period. The cumulative sum of residuals falls within the 5% critical bounds (red lines) throughout the temporal scope of the study, indicating parameter stability and supporting the reliability of the coefficient estimates.

**Discussion of Findings**

The ARDL results reveal a negative and statistically significant relationship between interest rate and manufacturing output in both the short run (coefficient: -24.00) and long run (coefficient: -64.24). This finding indicates that higher borrowing costs suppress industrial production, with the adverse effect intensifying over time. The magnitude of the long-run coefficient suggests that persistent high interest rates exert a considerably larger cumulative impact on manufacturing output than short-term fluctuations. This result is consistent with the Structuralist Theory of Development underpinning this study. As Prebisch (1950) and Furtado (1964) argued, developing economies with weak domestic production linkages experience amplified transmission of monetary tightening to the real sector. In Nigeria's case, the structural dependence on imported inputs and limited industrial depth magnify interest rate shocks. When lending rates rise historically exceeding 20–25 percent per annum in Nigeria manufacturing firms face prohibitive borrowing costs for working capital and machinery acquisition, given the scarcity of long-term credit. This erodes profit margins, discourages new investment, and forces production cuts. The finding also corroborates empirical evidence from Nigeria showing that elevated interest rates constrain manufacturers' ability to finance operations and suppress capacity expansion (Adelowokan et al., 2020; Adeneye, 2021; Anochie, 2023).

The negative interest rate effect is further exacerbated by Nigeria's challenging operating environment. Irregular power supply, poor transportation networks, and high logistics costs leave manufacturers with limited flexibility to absorb additional financing expenses. Consequently, interest rate increases translate directly into reduced output, capacity underutilization, and in some cases, plant closures. The interaction term between interest rate and local raw material utilization (ITMU) produces a positive and statistically significant effect on manufacturing output in both the short run (0.36) and long run (0.97). This confirms a genuine moderating effect: local raw material utilization weakens the adverse impact of

interest rate increases on manufacturing output. This finding aligns with the structuralist framework's emphasis on domestic production linkages as a buffer against external shocks. Greater reliance on locally sourced inputs reduces firms' exposure to exchange rate volatility, import financing costs, and global supply chain disruptions (UNCTAD, 2016; Adegbite et al., 2017). When faced with high interest rates, Nigerian manufacturers that shift procurement toward local raw materials reduce their foreign exchange requirements and import financing needs, thereby stabilizing production costs and supply chains. The positive interaction effect is also consistent with the Resource-Based View (RBV) of the firm (Barney, 1991), which argues that firms can achieve competitive advantage by leveraging locally available, non-replicable resources—particularly when external financial conditions are unfavorable. In Nigeria's context, manufacturers with established local sourcing networks possess strategic capabilities that competitors reliant on imported inputs cannot easily replicate, enabling them to maintain production continuity during periods of monetary tightening.

Furthermore, the finding supports the complementarity hypothesis in production theory, which posits that two inputs can become complementary when one helps overcome constraints imposed by the other (Milgrom & Roberts, 1990). Here, local raw material utilization complements the high-interest-rate environment by offering a cheaper, more accessible alternative to imported inputs. This transforms a potential liability (high interest rates) into an opportunity for firms to deepen domestic value chain integration.

These results corroborate recent empirical evidence showing that firms with stronger domestic input linkages exhibit greater resilience to interest rate shocks and monetary tightening (Aigbokhan, 2001; Uzonwanne, 2015; Adeniran & Onuba, 2020). The findings also align with Llorente-Alonso et al. (2024), who demonstrated that local input sourcing enhances industrial resilience during macroeconomic shocks, and with Nwankwo et al. (2024), who emphasized that backward integration strategies strengthen domestic value chains.

The Central Bank of Nigeria's Anchor Borrowers' Programme and Commercial Agriculture Credit Scheme have indirectly encouraged manufacturers to integrate local raw material supply networks by providing financing to agricultural producers and processors (Central Bank of Nigeria, 2019; Manufacturers Association of Nigeria, 2024). These interventions facilitate backward integration, reducing manufacturers' dependence on imported inputs and strengthening domestic linkages. However, the effectiveness of these programmes remains constrained by inadequate infrastructure, quality control challenges, and limited processing capacity, which continue to hinder the development of reliable local raw material supply chains.

The diagnostic results confirm the model's robustness. The $R^2$ (0.91) and adjusted $R^2$ (0.88) indicate that the independent variables explain 91 percent of the variation in manufacturing output, reflecting the critical importance of interest rates and raw material inputs for Nigerian manufacturers. The F-statistic from the bounds test (11.0) exceeds the upper bound critical value, confirming a stable long-run cointegrating relationship among the variables. The error correction coefficient (-0.37) indicates that 37 percent of short-run disequilibrium is corrected annually, with full equilibrium achieved in approximately 2 years and 7 months. The diagnostic tests serial correlation, heteroscedasticity, Ramsey RESET, and CUSUM confirm that the model is well-specified, free from autocorrelation and heteroscedasticity, correctly functional, and stable over the sample period. These results support the reliability of the coefficient estimates and the validity of statistical inference.

Taken together, the findings demonstrate that while high interest rates constrain manufacturing output in Nigeria, the strategic utilization of local raw materials creates a buffering effect that mitigates this adverse impact. Policies aimed at improving the quality, standardization, and supply chain integration of local raw materials could transform the

manufacturing sector's response to high interest rates, turning a constraint into an opportunity. The results align with the structuralist framework's emphasis on building productive linkages between financial systems and domestic supply chains to achieve sustainable industrial growth.

**Conclusion**

This study investigated the moderating effect of local raw materials on the relationship between interest rate and manufacturing output in Nigeria from 1981 to 2024, employing the ARDL approach. The findings reveal three key relationships. First, interest rate exerts a negative and significant effect on manufacturing output in both the short run and long run, confirming that higher borrowing costs constrain industrial production. Second, local raw material utilization exerts a positive direct effect on manufacturing output, underscoring its productive contribution. Third, the interaction term between interest rate and local raw material utilization is positive and significant, confirming a genuine moderating effect: manufacturers that utilize locally sourced inputs are better insulated from interest rate shocks, reducing exposure to exchange rate risk and import financing costs while improving output resilience. These findings affirm the structuralist proposition that domestic production linkages buffer the real sector against monetary tightening. They also support the Resource-Based View, demonstrating that firms leveraging locally available resources achieve competitive advantage during adverse macroeconomic conditions. The study contributes to literature by introducing local raw material utilization as a strategic moderating variable, filling a gap in Nigeria's manufacturing research.

**Recommendations**

Based on the findings, the following policy recommendations are proposed:

i. The Central Bank of Nigeria should adopt a differentiated interest rate framework, offering single-digit lending rates exclusively to manufacturers with verifiable local raw material sourcing records. The Manufacturing Sector Credit Facility should be restructured to include this conditionality, with quarterly certification by the Manufacturers Association of Nigeria. Manufacturers failing to meet local sourcing thresholds would access conventional market rates, creating a strong financial incentive to reduce import dependence.

ii. Fiscal authorities and development finance institutions should collaborate to establish a Local Raw Material Transition Incentive Programme (LRM-TIP). This initiative should incorporate: (a) tax credits to offset interest expenses proportional to increases in local raw material content; and (b) a dedicated transition fund administered by the Bank of Industry and Development Bank of Nigeria, offering medium-term loans at rates at least 300 basis points below the prime lending rate for capital expenditures to process and store local raw materials. This dual approach directly reduces transition costs during periods of high capital costs, amplifying the buffering effect of local raw materials against interest rate increases.

**Limitations**

This study has several limitations that should be acknowledged. First, the analysis relies on aggregate manufacturing output data, which masks heterogeneity across sub-sectors with varying degrees of local raw material dependence. Second, the sample size of 44 annual observations, while adequate for ARDL estimation, limits the ability to include additional control variables without sacrificing degrees of freedom. Third, the study focuses exclusively on interest rate, excluding other monetary policy instruments such as reserve requirements and open market operations. Fourth, local raw material utilization is proxied by aggregate data, which may not fully capture firm-level sourcing heterogeneity. Future research should disaggregate by sub-sector, incorporate firm-level survey data, and examine the role of other policy instruments.

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