MANUFACTURING AMID ECONOMIC VOLATILITY: THE ROLE OF OIL PRICES, EXCHANGE RATE, AND SUPPLY CHAIN DISRUPTIONS IN NIGERIA

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ABSTRACT
This study examines the dynamic effects of oil price volatility, exchange rate fluctuations, government expenditure, inflation, and supply chain disruptions on manufacturing output in Nigeria. Using quarterly data from 2000Q1–2024Q1, the analysis applies the Augmented Dickey–Fuller (ADF) test to determine the order of integration, bounds testing to assess long-run relationships, and a Vector Error Correction Model (VECM) to capture both short- and long-run dynamics. Impulse response functions (IRFs) and forecast error variance decomposition (FEVD) are employed to evaluate the direction, persistence, and relative contributions of shocks. Results reveal a mix of I(0) and I(1) variables, validating the bounds testing approach. Findings confirm cointegration between manufacturing GDP and selected macroeconomic indicators, indicating a stable long-run relationship. Exchange rate shocks exert the strongest and most persistent negative effects, supporting the "contractionary devaluation" hypothesis. Supply chain disruptions emerge as intensifying structural constraints, while oil price volatility influences output mainly through indirect and interaction-based channels. Government expenditure and inflation play secondary roles, often with adverse effects. The study underscores the need for coordinated macroeconomic and structural policies to stabilise the exchange rate, strengthen supply chains, and enhance public investment efficiency, thereby sustaining manufacturing growth amid volatility.

Keywords: Manufacturing output, Oil price volatility, Exchange rate, Supply chain disruption, Nigeria, VECM, Impulse response, Variance decomposition
JEL Codes: E32, E44, F31, L60, Q43

1. INTRODUCTION
The Nigerian manufacturing sector operates within an unstable economic environment marked by oil price fluctuations, exchange rate volatility, and recurring supply challenges. Developments in the international oil market directly shape industrial production and economic growth in Nigeria due to over reliance on crude oil exports which account for over 90% of foreign exchange earnings and about 60% share of government revenue, (NBS, 2025; OPEC, 2023). Manufacturing is particularly vulnerable because petroleum products serve as essential energy inputs and intermediate goods. Despite being a major crude oil producer, Nigeria depends heavily on imported refined petroleum products, machinery, and raw materials. This import reliance exposes manufacturers to external shocks and foreign exchange constraints, often resulting in higher production costs, disrupted input supply, and reduced output (Uzonwanne, 2015; Adeniran, Yusuf, & Adeyeye, 2020).

Exchange rate instability, especially since 2020, has further complicated manufacturing performance by raising the cost of imported inputs and capital equipment. Empirical studies confirm that oil price shocks affect manufacturing through multiple macroeconomic channels, including exchange rate movements, inflationary pressures, government revenue fluctuations,

and aggregate demand shifts (Adekoya & Oliyide, 2022; Adejola et al., 2022). However, most analyses emphasize these aggregate mechanisms while overlooking supply-side constraints.

Recent developments underscore the growing importance of supply-side factors such as rising energy costs, foreign exchange shortages, and logistical bottlenecks. Weak energy infrastructure and reliance on imported fuel intensify the impact of oil price volatility, leading to domestic energy price instability and supply chain disruptions that limit production capacity. Yet, existing studies often treat these disruptions as secondary outcomes rather than central transmission channels, leaving gaps in understanding the persistence of manufacturing contractions during oil price shocks.

This study addresses these gaps by examining the combined effects of oil price volatility, exchange rate movements, and supply chain disruptions on Nigeria's manufacturing output. It aims to identify the relative importance of these shocks and assess how structural constraints and interaction effects shape performance. Supply chain disruption is proxied using a local Energy Price Index (EPI), which reflects variations in electricity tariffs, fuel prices, and energy-related logistics costs. By integrating these factors into a unified empirical framework, the study provides a more context-specific explanation of Nigeria's manufacturing vulnerabilities and contributes to global debates on industrial resilience amid economic volatility. The findings are expected to guide policymakers and industry stakeholders in energy pricing, exchange rate management, and strategies to strengthen supply chain resilience for sustainable industrial development. The remainder of the paper is organized as follows: Section Two reviews the relevant literature; Section Three outlines the empirical methodology; Section Four presents and discusses the results; while the final section concludes the study.

2. LITERATURE REVIEW

2.1 Theoretical Perspectives

The performance of Nigeria's manufacturing sector under economic volatility is explained by several theoretical paradigms. Dutch Disease Theory (Corden & Neary, 1982) highlights how oil booms appreciate the real exchange rate, undermining competitiveness of non-oil tradables such as manufacturing. Real Business Cycle Theory (King & Rebelo, 1999) views oil price shocks as real productivity disturbances that propagate through energy costs, fiscal revenues, and investment, thereby inducing cyclical fluctuations in industrial output. Exchange Rate Pass-Through Theory emphasizes how exchange rate depreciation raises the cost of imported inputs, eroding competitiveness and profitability. Supply Chain Disruption and Resilience Theory (Christopher & Peck, 2004) underscores how infrastructural bottlenecks, energy price volatility, and logistics inefficiencies magnify production shortfalls in import-dependent industries, while resilience depends on adaptive capacity. Finally, Structuralist Theory of Inflation and Growth stresses that structural rigidities—scarcity of foreign exchange, poor infrastructure, and supply chain inefficiencies—are the true drivers of industrial fragility in developing economies. Collectively, these frameworks converge on the notion that Nigeria's manufacturing sector is highly vulnerable to external shocks and structural constraints.

2.2 Empirical Literature

2.2.1 Oil Price Volatility and Manufacturing

Oil price fluctuations have long been acknowledged as a major source of macroeconomic instability in Nigeria. Studies such as Akpan (2009) and Bamaiyi (2024) show that oil price shocks significantly influence aggregate economic indicators like GDP, exchange rates, and fiscal planning. However, only limited studies focus on sector-specific impacts like manufacturing. Abdulkareem and Kilishi (2016) stressed that oil price is a major source of

macroeconomic volatility, recommending diversification to reduce vulnerability. Yakubu and Akanegbu (2016) using time series data (1985–2016), show that oil price volatility has a negative but statistically insignificant effect on Nigeria's economic growth, indirectly constraining manufacturing expansion. Adedokun (2018), in an ARDL model covering 2009 to 2017, studied how fluctuations in the price of oil impart on Nigeria's manufacturing sector performance. The study found that changes in oil price significantly influence manufacturing output and recommends diversification of the Nigerian economy to reduce oil dependency. Gummi, e tal (2018) studied Effect of Oil Price Fluctuations on Manufacturing Performance in Nigeria for the 2009Q1 to 2017Q4 period using ARDL approach The study unveiled that fluctuation in oil price has a significant positive effect on manufacturing output, while interest rate and exchange rate have significant negative outcomes on manufacturing output Orgi etal (2019) examines the impact of crude oil price volatility on some selected economic sectors (transport, agricultural and manufacturing sectors) in Nigeria from1981q1 to 2015q4. The outcome revealed that Crude oil price has a negative impact and is statistically significant to transportation sector, manufacturing output, and agricultural sector respectively. Nwosu et al (2020) employed annual data covering 1981 to 2018 to estimate the influence of oil price shocks on 3 real sectors of the Nigerian economy, namely: agriculture, manufacturing and , industrial sectors , the outcome unveiled that shocks to oil price exhibited negative impact on the real sectors of the Nigeria economy Hammed and Arawomo (2020), using a Structural Vector Autoregressive (SVAR) model, investigated the impact of oil price shocks on Nigeria's manufacturing sector; via fiscal variable ranging from 1981 to 2019. The study found that oil prices have short and long run significant impact on government revenue. Besides, the study revealed that manufacturing output is influenced by oil price changes, government revenue and inflation. The results suggest that fiscal policy measures can help in curtailing the negative consequence of oil price swings on the manufacturing sector. Obi, et al (2023) explored the impact of crude oil price fluctuations on the Manufacturing, Agricultural, information and Communication sectors of the Nigerian economy. The results of the study found that crude oil price fluctuations had a positive and statistically significant effect on the manufacturing sector while it had negative and significant effect on agricultural and telecommunication sectors. Abe et al. (2024) found that oil price volatility negatively affects Nigeria's economic growth, with implications for industrial output and budget formulation. Anakwue et al. (2024) assessed the impact of oil price fluctuations on Nigeria's economic growth, agriculture, manufacturing, and government revenue between 1995 and 2024. Using a Vector Error Correction Model (VECM) and variance decomposition analysis, the study found that oil prices exert a modest but increasing influence on aggregate economic growth in the long run. The agricultural sector showed relative resilience to oil price shocks, with declining sensitivity over time, while the manufacturing sector exhibited increasing vulnerability, with oil price shocks accounting for a growing proportion of output variations. Government revenue was found to be highly sensitive to oil price movements, particularly in the medium term. The authors concluded that these asymmetric sectoral effects highlight the urgency of strengthening diversification policies and sector-specific resilience strategies. Amadi and Joro (2024) highlight the asymmetric effects of oil price shocks, showing that while periods of rising oil prices may temporarily boost government revenues, the subsequent volatility undermines manufacturing stability. Also, Kavkav et al. (2025) investigated the nexus between global oil price movements and exchange rate volatility with macroeconomic performance in Nigeria using fully modified OLS. It finds that exchange rate volatility negatively impacts growth while oil price movements remain significant in driving overall economic performance in this oil-dependent economy. The link with manufacturing is implicit through macroeconomic stability channels that affect industrial capacity and costs. Peter and Orshio (2025) show that

oil price shocks reduce industrial performance, highlighting the vulnerability of Nigeria's manufacturing sector.

2.2.2 Exchange Rate Instability and Sectoral Vulnerability

Exchange rate volatility presents a critical challenge for Nigerian manufacturers, particularly given their reliance on imported raw materials, machinery, and technology. Several studies have explored this relationship: Ali (2018) using an ARDL model demonstrated that exchange rate volatility negatively affects manufacturing performance over the long term. Orji and Ezeanyaeji (2022) analysed the influence of exchange rates on the manufacturing sector performance in Nigeria for the 1990 to 2020 period. The reported that exchange rate devaluation limits manufacturing sector while exchange rate fluctuation contracts manufacturing output. It recommended policy alignment with sectoral needs. Bayem et al. (2022) investigates how fluctuations in oil prices drive exchange rate instability in Nigeria, highlighting implications for industrial competitiveness. Adejola et al (2022) examined the nexus between oil price and exchange rates in Nigeria, using wavelet techniques. The study reveals co-movements between oil prices and the exchange rate, suggesting that exchange rate movements transmit oil price shocks into broader economic price dynamics. While not focused on manufacturing, this macro linkage frames why industry faces volatility in input costs and external competitiveness. Joro and Abu (2024) as well as Abiola (2025) show that different exchange rate regimes—whether fixed, managed float, or free float—have offered limited stabilizing effects, leaving manufacturers exposed to high production costs and uncertainty. Ajayi et al (2025) examined the effect of exchange rate on industrial performance in Nigeria. The study reported statistically significant negative impact of exchange rate on industrial performance in the long run, while its impact in the short run was positive and insignificant. Igbinovia et al (2025) evaluated the asymmetric responses of the Nigerian manufacturing sector to variations in exchange rates and bank credit. The outcome showed that exchange rate variation has significant countercyclical effects on manufacturing output while Bank credit to the private sector exhibited pro cyclical effects. Udoye et al (2025) reveal that exchange rate volatility significantly undermines productivity, particularly in industries reliant on imported raw materials and machinery. Nwikina et al (2025) examined the effect of exchange rate on manufacturing sector performance in Nigeria for the 1985 to 2022. The study established that real exchange rate has a significant adverse effect on manufacturing output in Nigeria. Effiong et al (2025) applying ARDL model on data ranging from 1981 to 2022, analysed how the manufacturing sector in Nigeria is affected by exchange rate. The study reported that exchange rate exercised significant negative influence on the manufacturing sector performance in Nigeria.

2.2.3 Supply Chain Disruptions: Energy Price as a Proxy

Nigerian manufacturing supply chains are characterized by significant complexities and vulnerabilities, further exacerbated by the volatile economic environment. Studies by Osagie et al. (2019) and Uzochukwu et al., 2020 highlighted that inadequate infrastructure power, transportation, and logistics, poses significant limitation to efficient supply chain management. This results in delays, higher operational costs, and weak competitiveness for manufacturers. Osagie et al argue further that the high dependence of many Nigerian manufacturing firms on imported raw materials and machinery exposes the sector to global supply chain disruptions. Moradeyo et al. (2023) and Adeyemi and Musa (2024) document how logistical bottlenecks, infrastructure deficits, and global disruptions reduce operational efficiency and hinder firms' ability to meet demand. Onuoha and Nwabudo (2023) emphasize the importance of resilience strategies, such as diversification of suppliers and digitalization of supply chain processes, in mitigating these disruptions. Their findings suggest that while external shocks are inevitable, firms that invest in resilience and adaptability are better positioned to sustain operations

during periods of volatility. Oni et al (2023) assesses port supply chain integration and manufacturing capacity utilisation in Lagos and Ogun states. It highlights that improvements in port throughput and logistics ("supply chain integration") can enhance manufacturing capacity utilisation, thereby mitigating some structural bottlenecks in Nigeria's industrial value chain – a relevant insight for supply chain resilience under volatility. Supply chain fragility in Nigeria is often driven by energy price volatility, which affects logistics, production costs, and input availability. Nwikina et al. (2025) showed that rising prices of PMS, diesel, and natural gas significantly increase inflation and production costs, indirectly disrupting supply chains.

2.3 Integrated Effects and Research Gap

The literature reveals that oil price volatility, exchange rate instability, and supply chain disruptions are interconnected forces shaping Nigeria's manufacturing environment. Their combined effects create a complex web of challenges for Nigeria's manufacturing sector. Oil price declines often trigger Naira depreciation, raising import costs, while energy price volatility inflates logistics and production expenses. Combined with infrastructural bottlenecks, these dynamics create a vicious cycle of high costs, inefficiency, and weak competitiveness, explaining the sector's persistently low GDP contribution and limited export capacity. Alabi and Oladehinde (2025) show that oil price shocks and currency fluctuations jointly constrain industrial productivity, while Oyeleke et al. (2025) demonstrate that sectoral performance is tightly linked to macroeconomic stability.

Despite extensive research on individual variables, integrated models that capture the interplay between oil prices, exchange rates, and supply chain disruptions remain scarce. Explicit empirical modelling of supply chain fragility—particularly its interaction with external shocks—has received limited attention. Addressing this gap requires comprehensive frameworks that account for multiple and interacting channels of volatility, thereby advancing understanding of how economic shocks constrain industrial development and informing resilience-oriented policy design.

3. METHODOLOGY

3.1 Theoretical Framework

This study examines the impact of oil price volatility on manufacturing sector performance in Nigeria, incorporating the roles of exchange rate fluctuations, domestic supply chain disruptions, government expenditure, and inflation. The theoretical framework integrates macroeconomic and structural perspectives to explain how external commodity price shocks transmit to industrial output in an oil-dependent economy.

The framework is grounded in three complementary theories. First, Dutch Disease Theory posits that oil price shocks affect manufacturing competitiveness through real exchange rate appreciation and sectoral resource reallocation. Second, the Exchange Rate Pass-Through and Competitiveness Theory explains how exchange rate volatility influences manufacturing output through changes in import costs, domestic prices, and export competitiveness. Third, Supply Chain Resilience Theory highlights how domestic operational constraints—particularly energy supply inefficiencies and logistics costs—magnify the adverse effects of external shocks on production.

Collectively, these theories conceptualise manufacturing output as the outcome of interacting macroeconomic shocks (oil price volatility, exchange rate movements) and domestic structural constraints (supply chain disruptions).

3.2 Model Specification and Estimation Technique

This study employs a Vector Error Correction Model (VECM) to analyse both the short-run dynamics and long-run equilibrium relationships between manufacturing output and selected macroeconomic and structural variables. The VECM is econometrically appropriate given the

non-stationary nature of the series and the existence of cointegration, which requires an estimation framework that preserves long-run information while modelling short-run adjustments.

The multivariate VECM treats all variables as jointly endogenous, thereby addressing potential simultaneity, reverse causality, and feedback effects among manufacturing output, oil price volatility, exchange rate movements, government expenditure, inflation, and domestic supply chain disruptions. This feature is particularly relevant in the Nigerian context, where macroeconomic volatility and industrial performance interact dynamically over time. The inclusion of an explicit error-correction term captures the speed at which short-run disequilibria adjust toward long-run equilibrium following external or domestic shocks.

Manufacturing output, proxied by Manufacturing Gross Domestic Product (MGDP), is modelled alongside oil price volatility (OIL_PVOL), supply chain disruption (SPCD), government expenditure (GEXP), exchange rate (EXRT), inflation (INFL), and an interaction term between oil price volatility and supply chain disruption ((OIL_PVOL x SPCD)). The inclusion of an interaction term within the multivariate framework allows for the explicit identification of amplification effects of oil price shocks under binding domestic structural constraints; thereby accounting for nonlinearities and structural shifts in the macroeconomic environment.

The endogenous variable vector is specified as:

Y_t = [*MGDP*, *OIL_PVOL*, *SPCD*, *GEXP*, *EXRT*, *INFL*, *OIL_PVOL×SPCD*]

The VECM is expressed as:

$$\Delta Y_t = \alpha(\beta' Y_{t-1}) + \sum_{i=1}^{k-1} \Gamma_i \Delta Y_{t-i} + \varepsilon_t$$

Where $\beta' Y_{t-1}$ represents the long-run cointegrating relationships, α denotes the adjustment coefficients, Γ_i captures short-run dynamic effects, and ε_t is a vector of serially uncorrelated disturbances. By incorporating both lagged differences and the long-run equilibrium error, the model accounts for persistence, dynamic interactions, and omitted-variable concerns common in macroeconomic time-series analysis.

To further mitigate concerns regarding parameter instability and regime shifts, the analysis is conducted over a sufficiently long sample period encompassing major oil price shocks, exchange rate regime changes, and domestic structural reforms. Dynamic responses are subsequently evaluated using impulse response functions and forecast error variance decomposition, ensuring that the estimated relationships are stable, interpretable, and policy-relevant.

3.3 Measurement of Variables

Oil price volatility (OIL_PVOL) is measured using Generalized Autoregressive Conditional Heteroskedasticity (GARCH) estimates derived from quarterly Bonny Light crude oil prices, capturing time-varying uncertainty in the global oil market. Domestic supply chain disruption (SPCD) is proxied by a local Energy Price Index (EPI), reflecting fluctuations in fuel prices, electricity tariffs, and logistics-related costs faced by manufacturing firms. The exchange rate (EXRT) is measured as the official naira–US dollar rate, government expenditure (GEXP)

represents aggregate public spending, and inflation (INFL) is measured using the consumer price index. No transformation was carried out on the variables.

3.4 Data Sources and Scope

The study utilises quarterly data spanning 2000Q1–2024Q1. Data on manufacturing GDP, exchange rate, government expenditure, inflation, energy price index and Bonny Light crude oil prices are sourced from the Central Bank of Nigeria (CBN) Statistical Bulletin and other official publications of the CBN. The sample period captures major oil price shocks, exchange rate regime changes, and domestic structural challenges affecting Nigeria's manufacturing sector. The use of quarterly data is justified by the need to capture short-run dynamics and adjustment processes in manufacturing output following oil price, exchange rate, and energy cost shocks, which are often obscured in annual data but central to the objectives of this study.

3.5 Pre-estimation Tests

Prior to estimation, Augmented Dickey–Fuller (ADF) unit root tests are conducted to determine the order of integration of the variables. Given evidence of non-stationarity at levels, the Bound Testing cointegration test is employed to establish the existence of long-run relationships among the variables. The optimal lag length for the VECM is selected using standard information criteria, including the Likelihood Ratio (LR), Final Prediction Error (FPE), Akaike Information Criterion (AIC), Schwarz Criterion (HQ).

3.6 Dynamic Analysis

To evaluate the transmission of shocks over time, Impulse Response Functions (IRFs) are employed to trace the response of manufacturing output to innovations in oil price volatility, exchange rate movements, and supply chain disruptions. In addition, Forecast Error Variance Decomposition (FEVD) is used to assess the relative contribution of each shock to fluctuations in manufacturing output over the forecast horizon. These procedures ensure the robustness of the empirical results and enhance the policy relevance of the findings.

4. RESULTS AND DISCUSSION OF FINDINGS

4.1 Unit Root Test

Table 1: Presentation of ADF Unit-Root Tests

S/N	Variables	Level			First Difference			Order of Integration
		ADF-Stat	5% Critical value	Unit root Present?	ADF-Stat	5% Critical value	Unit root Present?	
1	OIL_PVOL	-8.447888	-2.892200	NO	-	-	-	I(0)
2	MRGDP	-1.068453	-2.893230	YES	-3.206286	-2.893230	NO	I(1)
3	SPCD	4.246274	-2.892200	NO	-	-	-	I(0)
4	GEXP	2.962055	-3.458856	YES	-13.99941	-3.458856	NO	I(1)
5	EXRT	1.845159	-2.892536	YES	3.514075	-2.892536	NO	I(1)
6	INFL	-1.367835	-2.893230	YES	7.374542	-2.893230	NO	I(1)
7	OIL_PVOL*SPCD	-5.440525	-2.894716	NO	-	-	-	I(0)

The study examined the order of integration of the variables using the ADF test. The result as shown in table 1 revealed that the variables were of different order of integration at 5% level of significance. Using the ADF test, oil price volatility was found to be stationary at level while all other variables were stationary after first difference. Consequently, we conclude that the variables used in this study are a combination of I(0) and I(1).

4.2 Bound Test for Cointegration

Given the outcome of the unit root test where the variables were found to be a combination of I(0) and I(1) order of integration, we applied the bounds test cointegration technique. The result shows an F sat of 9.366281, which exceeds the Narayan's 5% critical lower and upper bounds values of 2.688 and 3.6988 respectively (see table 2). Hence we fail to accept the null hypothesis of no cointegration and conclude that there exists a cointegration among the variables. Therefore, a long- run relationship exists between Manufacturing__GDP and the other variables. Consequently, the study employed VEC for the estimation of the model

Table 2: Bound Test for Cointegration

Test Statistic	**Value**	**K**
F-statistic	9.366281	6
Critical Value Bounds		
Significance	I0 Bound	I1 Bound
10%	2.12	3.23
5%	2.45	3.61
2.5%	2.75	3.99
1%	3.15	4.43
Narayan's critical values		
5%	2.688	3.6988

Source: Author's computation using Eviews 9 on the data

4.3 VAR Lag Order Selection Criteria

VAR lag selection was conducted to determine the suitable lag for the model. The result is presented in table 3 and it shows that 3 out of the 5 criteria approved lag 5 as the optimal lag for the estimation of the model. Hence lag 5 was chosen as the optimal lag based on the LR, FPE and HQ criteria.

Table 3: Lag Selection

	LR	FPE	AIC	SC	HQ	Chosen Lag
Selected Lag Order	5	5	6	1	5	**5**

Source: Author's computation using Eviews 9 on the data

4.4 Interpretation and Discussion of Impulse Responses to Shocks

Table 4: Impulse response function of Manufacturing GDP

Period	**MRGDP**	**OIL_PVOL**	**GEXP**	**EXRT**	**INF**	**SPCD**	**OIL_PVOL* SPCD**
1	53438.12.	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000
2	43529.40	224.8114	-2687.384	-13187.29	39.98518	-1768.959	1724.548
3	38024.97	16262.21	-5422.028	-10073.31	1830.067	1184.600	949.1174
4	31295.00	655.9009	-2547.402	-38309.07	-8581.282	-13936.77	-6155.825
5	77110.69	13629.03	-8318.937	-13187.57	5702.609	12763.51	8032.362
6	62148.15	-571.3578	-17488.23	-70842.58	-19682.90	-31149.42	7674.102
7	57771.76	35156.20	-13192.45	-44863.32	-199.5745	-4793.188	20997.22
8	41003.14	5153.016	-12352.66	-112997.0	41907.63	-58451.06	1715 2.28
9	83355.17	39317.17	-19058.14	-52838.48	643.7456	2706.822	40585.78
10	64133.16	9286.462	-44105.84	-171504.3	-69131.06	-92343.67	46644.25

Source: computed with Eviews 9 by author

Table 4 presents the impulse response of Manufacturing Gross Domestic Product (MGDP) to one-standard-deviation shocks arising from its own innovations and from oil price volatility (OIL_PVOL), government expenditure (GEXP), exchange rate (EXRT), inflation (INFL), supply chain disruption (SPCD), and the interaction between oil price volatility and supply chain disruption (OIL_PVOL × SPCD) over a ten-quarter horizon within the VECM framework.

Response of Manufacturing Output to Own Shocks

The response of MGDP to its own shock is positive and persistent across the forecast horizon, although the magnitude fluctuates. The initial strong response in period 1 (53,438.12) reflects inertia and internal momentum within Nigeria's manufacturing sector, consistent with capital rigidity, adjustment costs, and slow technology diffusion. However, the subsequent oscillations suggest that internal shocks alone are insufficient to sustain stable long-run manufacturing growth without favourable macroeconomic and structural condition

Response to Oil Price Volatility (OIL_PVOL)

Surprisingly, MGDP responds positively but erratically to shocks in oil price volatility. While the response is modest in period 2, it becomes substantially positive from period 3 onward, peaking in periods 7 and 9. This pattern indicates that oil price volatility does not uniformly depress manufacturing output in Nigeria. In the short run, volatility may disrupt production planning and input costs, limiting manufacturing expansion. However, the medium- to long-run positive response suggests that periods of heightened oil price uncertainty may trigger fiscal adjustments, foreign exchange inflows, or import substitution incentives that indirectly benefit manufacturing activity. This may seem counterintuitive, but it suggests that in the Nigerian economy, oil price movements act as a primary driver of liquidity. Theoretically, the Uncertainty Hypothesis (Bernanke, 1983) suggests that volatility should suppress investment as firms "wait and see." However, our findings suggest a "Liquidity Effect" that overrides the uncertainty. In a mono-product economy like Nigeria, oil price increases—even volatile ones—expand the "fiscal space" and increase the foreign exchange available to the government and banks, which may temporarily ease credit or subsidy constraints for manufacturers, even if the long-term structural effect is unstable. These findings diverge from Elder and Serletis (2010), who found that oil volatility significantly reduces industrial output in the United States. Conversely, they align with Gummi, e tal (2018) and Obi, et al (2023) who reported significant positive impact of oil price shock on manufacturing in Nigeria. .

Response to Exchange Rate (EXRT)

Shocks to the exchange rate generate a strong and persistently negative response of MGDP across all periods, with particularly large contractions in periods 6, 8, and 10. In the Nigerian context, this reflects the "cost-push" effect. This provides empirical weight to the Structuralist Theory. While the Marshall-Lerner Condition suggests that a weaker currency should make exports cheaper and boost manufacturing, this assumes a robust domestic production base. In the Nigerian context, it reflects Nigeria's heavy dependence on imported manufacturing inputs, machinery, and intermediate goods. Exchange rate depreciation increases production costs, compresses profit margins, and constrains capacity utilization in manufacturing firms. The magnitude and persistence of the negative response underscore the vulnerability of the sector to exchange rate instability and weak pass-through mechanisms that fail to enhance export competitiveness. This mirrors the work of Krugman and Taylor (1978) on "Contractionary Devaluation" in developing countries. Our findings are consistent with Orji and Ezeanyaeji (2022) who reported significant adverse effects of exchange rate on the Nigerian manufacturing sector. The persistence of the negative response observed in Table 5 suggests that exchange rate instability constitutes a structural impediment to manufacturing growth, rather than a short-run adjustment cost.

Response to Supply Chain Disruption (SPCD)

MGDP exhibits erratic and predominantly negative response to shocks in supply chain disruption, especially from period 4 onward. Since SPCD is proxied by the Energy Price Index (fuel and electricity), large negative responses in periods 6, 8, and 10 indicate that rising domestic energy prices and logistics costs significantly undermine manufacturing performance. The volatility of the response suggests that manufacturers may try to absorb costs initially (Periods 3/5), but eventually succumb to the logistical burden. The predominantly negative response of manufacturing output to supply chain disruption shocks highlights a critical but underexplored channel in the Nigerian manufacturing literature. Rising energy prices, unreliable electricity supply, and high logistics costs directly undermine industrial productivity and competitiveness.

This result is consistent with supply chain resilience theory, which emphasizes the vulnerability of production systems to input and logistics disruptions. Recent empirical studies, especially in the post-COVID-19 period, have increasingly documented the adverse effects of energy and logistics shocks on manufacturing performance in developing economies. In particular, our finding that SPCD has a delayed but massive negative impact (Periods 8 and 10) aligns with Iwayemi (2008), who identified "energy poverty" as the primary "bottleneck" to Nigeria's industrialization. The findings underscore the structural nature of supply chain constraints in Nigeria and suggest that industrial performance is highly sensitive to domestic infrastructure and energy market conditions.

Response to Inflation (INFL)

The response of MGDP to inflation shocks is mixed and unstable. While modest positive effects appear in some periods (e.g., periods 3 and 5), inflation shocks become strongly negative in later periods, particularly in period 10. This pattern suggests that moderate inflation may initially reflect demand expansion or cost pass-through that temporarily supports output. However, sustained or high inflation erodes purchasing power, raises production costs, and increases uncertainty, ultimately exerting a contractionary effect on manufacturing output. The results reinforce the importance of price stability for long-term industrial performance.

Response to Government Expenditure (GEXP)

GEXP is consistently negative. This is a "crowding out" effect. It suggests that Nigerian government spending is likely not directed toward manufacturing infrastructure but perhaps toward debt servicing or consumption, which fails to stimulate industrial growth. Theoretically, this supports the Crowding-Out Effect rather than the Keynesian Multiplier. This finding that government expenditure shocks have limited and negative effects on manufacturing output resonates with the literature showing weak transmission of fiscal policy to industrial performance in Nigeria. Studies focusing on exchange rate and macroeconomic volatility often note that fiscal efficacy is constrained by structural weaknesses in public investment, resulting in limited productive spill overs to sectors such as manufacturing. For instance, research on exchange rate management finds that inflation and currency instability undermine manufacturing responsiveness to fiscal stimuli, even when government spending is substantial (Goshit et al., 2024). It also aligns with Folster and Henrekson (2001), who argue that in developing states with high corruption or inefficient bureaucracies, government spending actually hampers private sector growth by competing for credit and increasing the cost of doing business.

Response to the Interaction Term (OIL_PVOL × SPCD)

The interaction between oil price volatility and supply chain disruption produces a strong positive response of MGDP in several periods, particularly in the medium to long run. This result suggests that while oil price volatility and supply chain disruptions are individually disruptive, their combined effect may induce adaptive responses by firms and policymakers.

These may include input substitution, energy efficiency measures, local sourcing, and policy interventions that partially offset adverse shocks. Alternatively, it may reflect the "Inflationary Valuation"—where the GDP value rises because the unit price of manufactured goods skyrocketed, not because the volume of production increased. The positive interaction effect highlights the non-linear transmission of external shocks and the possibility of resilience-building mechanisms within the manufacturing sector. From a theoretical standpoint, this finding is consistent with models of adjustment under uncertainty, which posit that firms may respond to heightened volatility by restructuring production processes rather than uniformly contracting output. Although such interaction effects are rarely examined in the Nigerian literature, the result highlights the importance of accounting for non-linear and compounded shocks when analysing industrial performance in volatile environments.

4.5 Interpretation and Discussion of Variance Decomposition Results

Table 5: variance decomposition of the forecast error

S.E. Period	S.E.	MRGDP	OIL_ PVOL	SPCD	GEXP	EXRT	INFL	OIL_PVOL*SPCD
1	53438.12	100.0000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000
2	70268.94	96.20712	0.001024	0.063374	0.146262	3.521958	3.24E-05	0.060232
3	82368.71	91.32942	3.898679	0.066806	0.539758	4.058839	0.049387	0.057113
4	97694.69	75.18365	2.775914	2.082572	0.451682	18.26189	0.806655	0.437636
5	127197.2	81.10313	2.785630	2.235431	0.694193	11.84782	0.676853	0.656945
6	163655.0	63.41412	1.683971	4.973163	1.561265	25.89537	1.855379	0.616735
7	184410.2	59.75730	4.960650	3.984264	1.741379	26.31289	1.461355	1.782164
8	232600.1	40.66886	3.167170	8.819243	1.376604	40.13945	4.164689	1.663986
9	259628.2	42.94979	4.835369	7.089471	1.643742	36.35906	3.343325	3.779246
10	344161.7	27.91465	2.824553	11. 23381	2.577788	45.52421	5.937435	3.987559

Source: Author's computation using Eviews 9 on the data

Table 6 reports the forecast error variance decomposition (FEVD) of Manufacturing Gross Domestic Product (MGDP), indicating the relative contribution of shocks from oil price volatility, supply chain disruption, government expenditure, exchange rate movements, inflation, and their interaction to fluctuations in manufacturing output over a ten-quarter horizon. Unlike impulse responses, which trace the dynamic direction of shocks, variance decomposition provides insights into the relative importance of each source of disturbance in explaining manufacturing output variability. The table shows a clear transition from internal to external drivers of manufacturing volatility:

Dominance of Own Shocks and Structural Inertia (MRGDP): In the short run (Period 1), 100% of the variance is explained by the sector's own shocks. This outcome is consistent with standard time-series theory and the literature on industrial dynamics, which emphasises capital rigidity, adjustment costs, and slow technological change as key features of manufacturing sectors in developing economies. Although the contribution of own shocks declines steadily over time, MGDP continues to explain a substantial share of its own variance even in the long run (approximately 28 per cent by period 10). This persistence suggests that internal sector-specific factors—such as capacity constraints, firm-level productivity, and structural rigidities—remain important determinants of manufacturing performance, consistent with endogenous growth and structuralist perspectives.

The Dominant Driver (EXRT): Even though manufacturing has some internal momentum, it becomes increasingly dominated by outside forces over time. The Exchange Rate is the single most important external factor. Its contribution jumps from 3.5% in Period 2 to a staggering 45.52% by Period 10.

This finding is a classic empirical validation of the Structuralist School of Thought. In traditional Neoclassical Theory, the exchange rate is a price signal that should eventually lead to equilibrium. However, this outcome suggests an "Exchange Rate Trap." Since the Nigerian manufacturing sector is so heavily reliant on foreign inputs, the exchange rate ceases to be a mere "price" and becomes the "primary determinant" of survival; validating the theoretical expectation that an import-dependent manufacturing sector is highly sensitive to currency instability (Alesinloye et al 2024). This result is even stronger than the findings of Obansa et al. (2013), who found that the exchange rate significantly impacts Nigerian growth. Our finding of 45.5% suggests that the "pass-through" effect of currency volatility to industrial production has intensified in recent years, likely due to the widening gap between the official and parallel markets and the scarcity of forex. Thus, Efforts to stabilize the exchange rate could significantly reduce output volatility.

Supply Chain Disruptions (SPCD): Supply chain disruption (SPCD) shocks account for a relatively small share of manufacturing output variance in the short run but become increasingly important over time, contributing over 11 per cent by period 10. This gradual increase indicates that supply chain constraints—proxied by domestic energy prices and logistics costs—exert delayed but persistent effects on manufacturing performance. This factor emerges as the second most significant structural bottleneck. From a theoretical standpoint, this finding is consistent with supply-side and cost-push models, which suggest that disruptions to energy and logistics infrastructure accumulate over time, gradually eroding productive capacity. Our results align with Adenikinju (2005**)**, who argued that poor infrastructure (electricity and transport) acts as a tax on Nigerian manufacturing. The variance decomposition confirms that even if the exchange rate were stable, 11% of the manufacturing sector's "struggle" would still be dictated by energy and supply chain crises

Oil Price Volatility: Indirect and Limited Influence: Oil price volatility (OIL_PVOL) explains a relatively modest share of manufacturing output fluctuations throughout the forecast horizon, peaking at below 5 per cent. This is a crucial finding. It suggests that oil price uncertainty does not directly dominate manufacturing variability in Nigeria, despite the country's status as a major oil exporter. This outcome supports the view that oil price volatility affects manufacturing output primarily through indirect macroeconomic channels—such as fiscal revenue, exchange rate movements, and inflation—rather than through direct cost effects. The limited direct contribution of oil price volatility is consistent with the Indirect Transmission Mechanism found in the works of Iwayemi and Fowowe (2011). In Nigeria, oil price shocks are "laundered" through the exchange rate. When oil prices fluctuate, the central bank's ability to defend the Naira fluctuates; therefore, the "shock" shows up in the EXRT column rather than the OIL_PVOL column.

Government Expenditure and Inflation: Secondary but Non-negligible Roles: Shocks to government expenditure (GEXP) account for a small but gradually increasing share of manufacturing output variance, reaching approximately 2.6 per cent by period 10. This limited contribution suggests that public spending has not been a primary driver of manufacturing output fluctuations, which is consistent with the view that fiscal policy in Nigeria has had weak direct linkages with industrial production. This finding echoes the "Resource Curse" findings of Gelb (1988), where public spending in oil-rich states often becomes decoupled from industrial productivity.

Similarly, inflation (INFL) explains a modest share of manufacturing output variability, rising to nearly 6 per cent in the long run. This pattern suggests that inflationary pressures matter for

manufacturing performance but are not the dominant source of output fluctuations. From a theoretical perspective, this finding is consistent with the notion that inflation operates largely as a transmission channel for other shocks—particularly exchange rate and energy price movements—rather than as an independent driver of industrial volatility.

Interaction between Oil Price Volatility and Supply Chain Disruptions

The interaction term (OIL_PVOL × SPCD) contributes marginally to manufacturing output variance in the short run but becomes more relevant over longer horizons, accounting for nearly 4 per cent by period 10. This suggests that compounded shocks—arising from simultaneous external and domestic disturbances—play a non-trivial role in shaping manufacturing dynamics. Theoretically, this supports recent arguments that macroeconomic shocks do not operate in isolation and that interaction effects can amplify or alter the transmission of individual shocks. Although such interaction terms are rarely examined in traditional variance decomposition analyses, the result underscores the importance of modelling non-linear and joint shock effects in volatile economies. This supports recent theoretical arguments that firms in volatile environments may respond to multiple shocks through reorganisation, substitution, and efficiency gains rather than uniform contraction.

5. CONCLUSION AND POLICY RECOMMENDATION

5.1 Conclusion

This study examined the dynamic effects and relative importance of macroeconomic volatility and supply-side constraints on manufacturing output in Nigeria, using a Vector Error Correction Model (VECM) framework with impulse response functions (IRFs) and forecast error variance decomposition (FEVD). By jointly analysing short- and long-run responses alongside the sources of manufacturing output fluctuations, the study provides a comprehensive account of how oil price volatility, exchange rate movements, fiscal policy, inflation, and supply chain disruptions interact to shape manufacturing performance in an oil-dependent developing economy.

The empirical evidence indicates that manufacturing output in Nigeria exhibits strong persistence, reflecting structural inertia, adjustment costs, and internal sectoral rigidities. While own shocks remain important, the results clearly show that external macroeconomic disturbances—particularly exchange rate instability—play a dominant role in explaining manufacturing output volatility. The IRF results reveal that exchange rate shocks exert a strong and persistently negative effect on manufacturing output, while the FEVD results demonstrate that exchange rate innovations account for the largest share of forecast error variance over the medium to long run. Together, these findings underscore the centrality of exchange rate dynamics as both a contractionary force and a structural driver of manufacturing instability.

Supply chain disruptions, proxied by domestic energy and logistics costs, also emerge as a critical constraint on manufacturing performance. The IRF analysis shows that such disruptions exert increasingly negative effects over time, while the FEVD results confirm their growing contribution to manufacturing output variability in the long run. This combination of dynamic response and variance contribution suggests that supply chain constraints operate as slow-moving but persistent structural impediments rather than transitory shocks, reinforcing the importance of infrastructure and energy conditions in industrial development.

Oil price volatility, despite Nigeria's heavy reliance on the oil sector, exerts a more nuanced and indirect influence on manufacturing output. The impulse responses indicate that oil price volatility can generate episodic positive effects, likely through fiscal and liquidity channels,

yet the variance decomposition shows that it explains only a limited share of manufacturing output fluctuations. This contrast suggests that oil price volatility affects manufacturing primarily through transmission mechanisms—particularly exchange rate movements and supply chain conditions—rather than as an autonomous driver of industrial instability.

Government expenditure and inflation are found to play secondary roles in shaping manufacturing output dynamics. Shocks to public spending exert a negative effect on manufacturing output in the impulse response analysis but account for only a modest share of output variance, indicating weak and potentially distortionary linkages between fiscal policy and industrial performance. Inflation shocks display mixed short-run effects but become contractionary over longer horizons, functioning mainly as a channel through which other macroeconomic disturbances—especially exchange rate and energy price shocks—are transmitted to the manufacturing sector.

An important contribution of this study lies in its consideration of interaction effects. The positive response of manufacturing output to the interaction between oil price volatility and supply chain disruptions suggests the presence of adaptive or adjustment mechanisms when multiple shocks occur simultaneously. Although the variance contribution of this interaction remains modest, its increasing relevance over time highlights the importance of accounting for non-linear and compounded shocks in analyses of manufacturing performance in volatile environments.

Overall, the findings suggest that manufacturing performance in Nigeria is shaped by a complex interaction of macroeconomic instability and structural constraints. Exchange rate volatility and supply chain disruptions constitute the most persistent and influential sources of manufacturing output fluctuations, while oil price volatility operates indirectly through broader macroeconomic channels. These results align with structuralist and open-economy theories, which emphasise that in resource-dependent and import-intensive economies, macroeconomic volatility can undermine industrial development in the absence of complementary structural reforms.

The broader implication is that macroeconomic stabilisation, while necessary, is insufficient to drive sustained manufacturing growth. Long-term industrial development requires policies that reduce exchange rate instability, strengthen domestic supply chains, improve energy and logistics infrastructure, and enhance the efficiency of fiscal interventions. By integrating dynamic responses with variance-based evidence, this study contributes to the empirical literature on manufacturing amid economic volatility and provides a nuanced understanding of the channels through which macroeconomic shocks influence industrial performance in Nigeria.

5.2 Policy Recommendations

Consistent with the study's objective of examining how macroeconomic volatility and supply-side disruptions affect manufacturing output in Nigeria, the empirical results point to several targeted policy considerations.

First, the finding that exchange rate shocks exert both the strongest contractionary effects and the largest contribution to manufacturing output variability suggests that exchange rate stability is central to industrial performance. Policies aimed at reducing excessive exchange rate volatility—rather than pursuing nominal depreciation as a competitiveness strategy—would mitigate cost pressures on import-dependent manufacturing firms and enhance output stability.

Second, the significant and increasing role of supply chain disruptions in explaining manufacturing fluctuations directly supports the study's focus on domestic structural constraints. Improving electricity reliability, moderating domestic energy price volatility, and reducing logistics and transportation costs would address key cost-side bottlenecks identified in both the impulse response and variance decomposition analyses.

Third, the weak and negative linkage between government expenditure and manufacturing output indicates that public spending has not effectively supported industrial productivity. In line with the study's objective of assessing transmission mechanisms, this result suggests the need to reorient fiscal policy toward productivity-enhancing capital investments—particularly in energy, transport, and industrial infrastructure—rather than expanding aggregate expenditure without sectoral targeting.

Fourth, while oil price volatility is shown to have a limited direct influence on manufacturing output, its indirect and interaction-based effects highlight the importance of coherent macroeconomic coordination. Strengthening fiscal and external buffers would reduce the transmission of oil price shocks through exchange rate instability and domestic cost pressures, thereby supporting manufacturing resilience.

Finally, the role of inflation as a transmission channel rather than a primary driver of manufacturing volatility underscores the importance of coordinated monetary and fiscal policies that limit cost-induced inflationary pressures, particularly those originating from exchange rate and energy price movements.

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