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ASSESSING THE IMPACT OF FOREIGN DIRECT INVESTMENT ON THE GROWTH OF NIGERIA'S MANUFACTURING AND AGRICULTURAL SECTORS

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ABSTRACT

This study examines how foreign capital inflows and macroeconomic fundamentals affect Nigeria's agricultural and manufacturing sectors between 1990 and 2024. Using two ARDL models, the Bounds test confirms long-run relationships in both sectors. Long-run results show that gross fixed capital formation significantly improves performance, whereas trade openness has a negative effect, indicating structural import dependence. Inflation positively affects agriculture, whereas foreign direct investment and exchange rates are largely insignificant. In the short run, changes in foreign direct investment and capital formation influence performance, while trade openness remains negative. Error-correction terms are significant and negative, confirming rapid adjustment to equilibrium. Diagnostic tests support model robustness, and Toda–Yamamoto causality tests indicate unidirectional causality from foreign direct investment, capital formation, and trade to sectoral performance.

Keywords: Foreign Direct Investment, Manufacturing Sector, Agricultural Sector, ARDL, Capital formation.

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1. Introduction

Foreign Direct Investment (FDI) is widely recognised as a vital catalyst for development in emerging economies such as Nigeria, providing essential capital, technology, and access to global markets that help diversify away from primary commodities and modernise key sectors, including manufacturing and agriculture (Nunnenkamp, 2004; UNCTAD, 2023). However, Nigeria's FDI inflows have historically been concentrated in extractive industries, limiting broader spill-overs to manufacturing and agriculture and contributing to sectoral underperformance. While manufacturing's share of GDP remains modest, agriculture remains a major source of employment yet struggles with underinvestment and technological gaps, underscoring the need to assess whether FDI complements or crowds out domestic investment in these areas.

According to UNCTAD's World Investment Report, global FDI flows fluctuated sharply between 2020 and 2023 due to global uncertainties, commodity price swings, and geopolitical tensions (UNCTAD, 2023). In Nigeria, FDI inflows rose to about USD 1.08 billion in 2023, following currency reforms and renewed investor confidence (World Bank, 2024; CBN, 2023). As these changes may have affected sectoral responses to FDI, previous studies may not fully capture current dynamics. Therefore, updating the evidence to 2024 is both relevant and timely.

Despite Nigeria's consistent efforts to attract FDI inflows into the agricultural and manufacturing sectors, which remain relatively low and uneven, limiting their potential contribution to economic diversification and sustainable growth. Over the years, most FDI has been concentrated in the oil and gas sector, while agriculture, Nigeria's largest employer of labour, and manufacturing, critical for industrialisation, have struggled to leverage foreign capital for improved productivity, technology transfer, and value addition. As a result, both sectors continue to experience low output, weak competitiveness, inadequate infrastructure, and limited modernisation. The extent to which FDI inflows have influenced the performance of agriculture and manufacturing in Nigeria between 1990 and 2024, therefore, remains unclear. This gap creates the need for an empirical investigation to determine whether FDI has significantly impacted these sectors and to identify the factors that may be constraining its effectiveness.

Research Questions

- a) What is the impact of foreign direct investment on the growth of Nigeria's manufacturing sector between 1990 and 2024?
- b) How does foreign direct investment influence the growth of Nigeria's agricultural sector over the same period?

Objective of the Study

- a) Examine the long-run and short-run effects of foreign direct investment on the growth of Nigeria's manufacturing sector.
- b) Assess the impact of foreign direct investment on the growth of Nigeria's agricultural sector in both the short run and long run.

2.0. Literature Review

2.1. The Conceptual Literature

Manufacturing Sector: The manufacturing sector involves transforming raw materials into intermediate or finished goods using industrial processes and technology (UNIDO, 2022). Conceptually, it is central to economic transformation because it drives productivity growth, job creation, and export diversification (Rodrik, 2016). In Nigeria, the sector faces challenges related to low industrial capacity, limited technology adoption, and inadequate investment, which hinder competitiveness (Adewuyi & Adegboye, 2021). FDI is therefore seen as a critical channel for upgrading technology, improving managerial practices, and strengthening industrial linkages (Saggi, 2002), although its effectiveness depends on stable policies and supportive infrastructure.

Agricultural Sector: The agricultural sector encompasses crop farming, livestock production, fisheries, and agro-processing activities that support food security and rural livelihoods (FAO, 2021). Conceptually, agriculture plays a foundational role in developing economies by promoting employment, poverty reduction, and raw material supply to industry (Johnston & Mellor, 1961). In Nigeria, the sector suffers from low mechanization, climate vulnerability, and limited access to modern inputs, reducing overall productivity (World Bank, 2019). FDI has the potential to improve the sector by introducing improved seeds, irrigation systems, mechanization, and agribusiness expertise (OECD, 2020), though its impact is mediated by land policies, infrastructure, and farmers' capacity to absorb new technologies.

2.2 Theoretical Literature

Foreign Direct Investment (FDI) has been widely analyzed through several theoretical frameworks that explain how external capital influences sectoral growth, productivity, and structural transformation. Key among these frameworks are the Eclectic Paradigm, Endogenous Growth Theory, the Neoclassical Growth Model, Spillover Theory, and Dependency Theory.

The Eclectic Paradigm (OLI Model) proposed by Dunning (1980, 1988) explains FDI decisions based on ownership, location, and internalization advantages. Ownership advantages include firm-specific assets such as advanced technology and managerial expertise, while location advantages reflect host-country characteristics such as market size, resource endowments, and institutional environment. Internalization advantages arise when firms find it more efficient to control operations rather than license them. In the Practical context, the OLI framework (Dunning, 1980; 1988) explains how FDI enhances manufacturing

productivity through technology transfer, modern machinery, and improved management practices, as well as agricultural performance through mechanization, improved seeds, and modern inputs.

The Endogenous Growth Theory, advanced by Romer (1986, 1990), emphasizes that long-run growth is driven by innovation, human capital accumulation, and knowledge spillovers. Within this framework, FDI is viewed as an important channel for transferring advanced technologies and skills. In Nigeria, FDI inflows into manufacturing and agriculture can raise productivity by introducing improved production techniques and inputs, provided that absorptive capacity such as domestic investment, skilled labor, and trade openness is sufficiently developed (Romer, 1986; 1990).

The Neoclassical Growth Model developed by Solow (1956) regards FDI as a source of external capital that supplements domestic savings and accelerates capital accumulation. For Nigeria, where domestic investment is often inadequate, FDI supports the expansion of manufacturing capacity and the modernization of agriculture. However, consistent with Solow (1956), the model suggests that long-term growth depends largely on exogenous technological progress rather than capital accumulation alone. The Spillover Theory of Multinational Enterprises, articulated by Blomström and Kokko (1998), explains how foreign firms generate productivity gains through demonstration effects, labor mobility, and linkages with local firms. These spillovers can strengthen Nigeria's manufacturing and agricultural value chains if domestic firms possess sufficient learning capacity. In contrast, Dependency Theory, associated with Prebisch (1950) and Dos Santos (1970), cautions that FDI may reinforce structural dependence if foreign firms dominate key sectors without strong domestic linkages.

Overall, the Eclectic Paradigm, complemented by Endogenous Growth Theory, provides the most relevant framework for explaining how FDI influences manufacturing and agricultural development in Nigeria by linking investment decisions to technology transfer, productivity gains, and sectoral transformation.

2.3 Empirical Literature Review

Dinda (2021) investigates panel data from developing countries and finds that FDI exerts stronger long-run effects on manufacturing value added compared to agricultural value added, employing fixed effects and system-GMM estimators to address potential endogeneity. While the study is limited by country-specific policy heterogeneity and challenges in isolating sectoral FDI, its findings support separate modelling of manufacturing and agriculture for Nigeria and justify the inclusion of absorptive-capacity controls, such as human capital, gross fixed capital formation (GFCF), and trade openness. Similarly, Nyiwul and Koirala (2022), using a panel VAR framework and impulse-response analysis across 16 developing countries, report mixed short-run agricultural responses to FDI, emphasizing the mediating roles of institutional quality and rural infrastructure. Their results imply that studies on Nigeria should not assume uniform agricultural benefits from FDI inflows.

Chizema (2025), applying FGLS, common correlated effects, and 2SLS estimators across South and Southeast Asian countries, finds robust positive effects of FDI on manufacturing growth, whereas the

impact on agriculture is comparatively weaker. Despite regional differences, the study's methodological rigor is instructive for Nigerian research, where endogeneity concerns are also pertinent. UNCTAD (2024) further highlights that Greenfield FDI in manufacturing generates stronger local linkages than extractive projects, suggesting that aggregate FDI measures may obscure sector-specific spillovers that are particularly relevant for Nigeria's manufacturing performance. Sultana (2023), using ARDL and ECM techniques in Bangladesh, reports a long-run negative relationship between aggregate FDI and agricultural output, attributing this to FDI concentration in non-agricultural sectors. Her treatment of structural breaks is especially relevant for Nigeria, which has experienced significant policy and economic shocks.

For Nigeria, sector-specific evidence is provided by Okpalla et al. (2022), who, employing ARDL and ECM approaches, find positive long-run effects of manufacturing-targeted FDI on manufacturing value added, while aggregate FDI exhibits weaker associations. They emphasize measurement challenges in sectoral FDI and the importance of robustness checks. Similarly, Adeagbo and Jimoh (2023) report positive long-run effects of FDI on manufacturing and mixed outcomes for agriculture, although their short sample period limits generalizability. Yilgak'Ha et al. (2024) confirm significant positive long-run elasticity of manufacturing output with respect to FDI using ARDL, while Sokunbi et al. (2024), applying DOLS and ARDL methods, demonstrate that FDI directed toward agribusiness improves agricultural employment and value added more effectively than aggregate FDI. Collectively, these Nigerian studies underscore the importance of sectoral disaggregation, the use of robust estimation techniques, and the inclusion of key controls such as exchange rate dynamics and oil-price effects to accurately assess the sectoral impacts of FDI.

Despite growing evidence, several gaps remain. Cross-country studies fail to capture Nigeria's unique structural constraints, such as weak industrial linkages, uneven absorptive capacity, and institutional limitations, thus requiring country-specific analysis. Many single-country studies also overlook interaction effects (e.g., $FDI \times openness$, $FDI \times domestic\ investment$), limiting understanding of how local economic conditions shape FDI outcomes. Another gap is the limited number of integrated studies jointly examining manufacturing and agricultural sectors within one empirical framework, despite their interlinked roles in Nigeria's economy. Finally, no recent Nigerian study has assessed sectoral heterogeneity using a long time series covering 1990–2024, leaving unanswered whether FDI affects the two sectors differently and whether spill-overs flow between them.

3. Methodology

This study employs an ex-post facto research design, analyzing historical time-series data spanning 1990 to 2024, as the economic variables of interest cannot be experimentally manipulated. The methodology is grounded in the ARDL framework developed by Persian, Shin, and Smith (2001), which is suitable for

identifying long-run relationships, dynamic adjustments, and short-run causal interactions among macroeconomic variables.

To capture the sector-specific impacts of Foreign Direct Investment (FDI), the study adopts and modifies established empirical models for manufacturing and agriculture. For the manufacturing sector, the model is adapted from Lean and Tan (2011) to reflect Nigeria’s context.

Model 1: Manufacturing Sector

$$MSP = f(FDI, GFCF, OPEN, EXR, INF) \dots\dots\dots 3.1$$

Where MSP is Manufacturing Sector Performance; FDI is Foreign Direct Investment; GFCF is Gross Fixed Capital Formation; OPEN is Trade Openness; EXR = Exchange Rate; INF is Inflation Rate.

For the agricultural sector, the model is adapted from Adegboye and Adekunle (2020) to account for sectoral dynamics in Nigeria:

Model 2: Agricultural Sector

$$AGO = f(FDI, GFCF, OPEN, EXR, INF) \dots\dots\dots 3.2$$

Where AGO is Agricultural Output, FDI is Foreign Direct Investment; GFCF is Gross Fixed Capital Formation; OPEN is Trade Openness; EXR is Exchange Rate, and INF is Inflation Rate. These two models are thus adopted and modified to simultaneously examine the short-run and long-run effects of FDI and key macroeconomic variables on Nigeria’s manufacturing and agricultural sectors, ensuring both sectoral specificity and consistency with previous empirical research. Log-linear specification (for improved normality, linearity, elasticity interpretation, and reduced heteroskedasticity)

$$Log\,MSP_t = \beta_0 + \beta_1\,Log\,FDI_t + \beta_2\,Log\,GFCF_t + \beta_3\,OPEN_t + \beta_4\,EXR_t + \beta_5\,INF_t + \mu_t \dots\dots 3.3$$

$$Log\,AGO_t = \beta_0 + \beta_1\,Log\,FDI_t + \beta_2\,Log\,GFCF_t + \beta_3\,OPEN_t + \beta_4\,EXR_t + \beta_5\,INF_t + \mu_t \dots\dots 3.4$$

The Augmented Dickey-Fuller (ADF) test, developed by Dickey and Fuller (1979, 1981), is a widely used method for detecting unit roots in a time series. It tests whether shocks are temporary and the series is stationary, a prerequisite for long-run equilibrium analyses such as cointegration (Glynn et al., 2007). The ADF test also informs the suitability of the ARDL approach (Pesaran et al., 2001).

$$\Delta Y_t = \mu + \alpha Y_{t-1} + \sum_{i=1}^k \beta_i \Delta Y_{t-i} + \varepsilon_t \dots\dots\dots 3.5$$

$$\Delta Y_t = \mu + \beta t + \alpha Y_{t-1} + \sum_{i=1}^k \beta_i \Delta Y_{t-i} + \varepsilon_t \dots\dots\dots 3.6$$

$$\Delta Y_t = \alpha Y_{t-1} + \sum_{i=1}^k \beta_i \Delta Y_{t-i} + \varepsilon_t \dots\dots\dots 3.7$$

where Δ denotes the first difference, Y_t is the series, μ is the intercept, t is the trend (if included), Y_{t-1} is the lagged level, k is the lag length, i indexes the lagged differences, and ε_t is white noise ($\varepsilon_t \sim iid(0, \sigma^2)$).

The ARDL Bound approach to cointegration is employed to determine the cointegration or long-term associations between MSP and FDI, GFCF, OPEN, EXR, and INF. This will be done using the bounds approach and is present follows;

$$\Delta \log MSP_t = \beta_0 + \beta_1 \log MPS_{t-1} + \log \beta_2 FDI_{t-1} + \log \beta_3 GFCF_{t-1} + \beta_4 OPEN_{t-1} + \beta_5 EXR_{t-1} + \beta_6 INF_{t-1} + \sum_{i=1}^q \alpha_1 \log MPS_{t-1} + \sum_{l=0}^{k_2} \alpha_2 \log \alpha_2 FDI_{t-1} + \sum_{l=0}^{k_3} \alpha_3 \log GFCF_{t-1} + \sum_{l=0}^{k_4} \alpha_4 OPEN_{t-1} + \sum_{l=0}^{k_5} \alpha_5 EXR_{t-1} + \sum_{l=0}^{k_6} \alpha_6 INF_{t-1} + \epsilon_t \dots \dots \dots 3.8$$

The short-term coefficients are denoted by β_i in the equation above, and long-term coefficients are denoted by α_i with $I = 1 \dots n$. Short-run analysis determines the immediate impact of explanatory variables on dependent variables, whereas the long-run analysis reveals the rate of adjustment to the equilibrium level. MSP/AGO is the explanatory variable, with optimal lag q ; whilst FDI, GFCF, OPEN, EXR, and INF are used as explanatory variables, with k_i optimal lags. The short-run ARDL model estimates the error correction term (ECT), with the rate of change of the equation to long-term equilibrium convergence. Equation (9) is a combination of long and short-term models. The long- term section is stated as:

$$\Delta \log MSP_t = \alpha_0 + \alpha_1 \log MPS_{t-1} + \log \alpha_2 FDI_{t-1} + \log \alpha_3 GFCF_{t-1} + \alpha_4 OPEN_{t-1} + \alpha_5 EXR_{t-1} + \alpha_6 INF_{t-1} + ECT + \epsilon_t \dots \dots \dots 3.9$$

The short-term section of Equation (10) is stated as:

$$\Delta \log MSP_t = \beta_0 + \sum_{i=1}^q \beta_1 \log MPS_{t-1} + \sum_{l=0}^{k_2} \beta_2 \log \beta_2 FDI_{t-1} + \sum_{l=0}^{k_3} \beta_3 \log GFCF_{t-1} + \sum_{l=0}^{k_4} \beta_4 OPEN_{t-1} + \sum_{l=0}^{k_5} \beta_5 EXR_{t-1} + \sum_{l=0}^{k_6} \beta_6 INF_{t-1} + \epsilon_t \dots \dots \dots 3.10$$

For Model 2

$$\Delta \log AGO_t = \beta_0 + \beta_1 \log ARO_{t-1} + \log \beta_2 FDI_{t-1} + \log \beta_3 GFCF_{t-1} + \beta_4 OPEN_{t-1} + \beta_5 EXR_{t-1} + \beta_6 INF_{t-1} + \sum_{i=1}^q \beta_1 \log AGO_{t-1} + \sum_{l=0}^{k_2} \beta_2 \log \beta_2 FDI_{t-1} + \sum_{l=0}^{k_3} \beta_3 \log GFCF_{t-1} + \sum_{l=0}^{k_4} \beta_4 OPEN_{t-1} + \sum_{l=0}^{k_5} \beta_5 EXR_{t-1} + \sum_{l=0}^{k_6} \beta_6 INF_{t-1} + \epsilon_t \dots \dots \dots 3.11$$

$$\Delta \log AGO_t = \alpha_0 + \alpha_1 \log AGO_{t-1} + \log \alpha_2 FDI_{t-1} + \log \alpha_3 GFCF_{t-1} + \alpha_4 OPEN_{t-1} + \alpha_5 EXR_{t-1} + \alpha_6 INF_{t-1} + ECT + \epsilon_t \dots \dots \dots 3.12$$

The short-term section of Equation (10) is stated as:

$$\Delta \log AGO_t = \beta_0 + \sum_{i=1}^q \beta_1 \log AGO_{t-1} + \sum_{l=0}^{k_2} \beta_2 \log \beta_2 FDI_{t-1} + \sum_{l=0}^{k_3} \beta_3 \log GFCF_{t-1} + \sum_{l=0}^{k_4} \beta_4 OPEN_{t-1} + \sum_{l=0}^{k_5} \beta_5 EXR_{t-1} + \sum_{l=0}^{k_6} \beta_6 INF_{t-1} + \epsilon_t \dots \dots \dots 3.13$$

The Toda–Yamamoto (1995) causality approach is appropriate for this study because it allows the examination of causal relationships between FDI and sectoral performance (manufacturing and agriculture) without requiring pre-testing for cointegration among the variables. Furthermore, the approach is robust in small samples and suitable for macroeconomic time-series data. The equation specification is stated as:

$$\text{LogMSP}_t = \alpha_0 + \sum_{i=1}^k \gamma_{1t} \text{LogMSP}_{t-1} + \sum_{j=k+1}^{k+d_{\max}} \gamma_{2j} \text{LogAGO}_{t-1} + \sum_{i=1}^k \vartheta_{1t} \text{Log FDI}_{t-1} + \sum_{j=k+1}^{k+d_{\max}} \vartheta_{2j} \text{LogGFCF}_{t-1} + \sum_{i=1}^k \varepsilon_{1t} \text{OPEN}_{t-1} + \sum_{j=k+1}^{k+d_{\max}} \varepsilon_{2t} \text{EXR}_{t-1} + \sum_{i=1}^k \beta_{1t} \text{INF}_{t-1} + \mu_{1t} \dots \dots \dots 3.14$$

$$\begin{aligned} \text{LogFDI}_t &= \alpha_0 + \sum_{i=1}^k \gamma_{1t} \text{LogFDI}_{t-1} + \sum_{j=k+1}^{k+d_{\max}} \gamma_{2j} \text{LogAGO}_{t-1} + \sum_{i=1}^k \vartheta_{1t} \text{LogMSP}_{t-1} + \\ &\sum_{j=k+1}^{k+d_{\max}} \vartheta_{2j} \text{LogGFCF}_{t-1} + \sum_{i=1}^k \varepsilon_{1t} \text{OPEN}_{t-1} + \sum_{j=k+1}^{k+d_{\max}} \varepsilon_{2t} \text{EXR}_{t-1} + \sum_{i=1}^k \beta_{1t} \text{INF}_{t-1} + \\ &\mu_{1t} \dots \dots \dots 3.15 \\ \text{LogAGO}_t &= \alpha_0 + \sum_{i=1}^k \gamma_{1t} \text{LogAGO}_{t-1} + \sum_{j=k+1}^{k+d_{\max}} \gamma_{2j} \text{LogMSP}_{t-1} + \sum_{i=1}^k \vartheta_{1t} \text{LogFDI}_{t-1} + \\ &\sum_{j=k+1}^{k+d_{\max}} \vartheta_{2j} \text{LogGFCF}_{t-1} + \sum_{i=1}^k \varepsilon_{1t} \text{OPEN}_{t-1} + \sum_{j=k+1}^{k+d_{\max}} \varepsilon_{2t} \text{EXR}_{t-1} + \sum_{i=1}^k \beta_{1t} \text{INF}_{t-1} + \\ &\mu_{1t} \dots \dots \dots 3.16 \\ \text{LogGFCF}_t &= \alpha_0 + \sum_{i=1}^k \gamma_{1t} \text{LogGFCF}_{t-1} + \sum_{j=k+1}^{k+d_{\max}} \gamma_{2j} \text{LogAGO}_{t-1} + \sum_{i=1}^k \vartheta_{1t} \text{LogFDI}_{t-1} + \\ &\sum_{j=k+1}^{k+d_{\max}} \vartheta_{2j} \text{LogMSP}_{t-1} + \sum_{i=1}^k \varepsilon_{1t} \text{OPEN}_{t-1} + \sum_{j=k+1}^{k+d_{\max}} \varepsilon_{2t} \text{EXR}_{t-1} + \sum_{i=1}^k \beta_{1t} \text{INF}_{t-1} + \\ &\mu_{1t} \dots \dots \dots 3.14 \end{aligned}$$

Table 1: Variable Measurement and Data Sources

Variable	Type of Variable	Measurement / Operational Definition	Expected Sign	Source of Data
MSP	DV	Manufacturing Value Added (MVA) as % of GDP, or manufacturing output index in constant prices	-	WDI 2025, CBN 2025
FDI	I V	Net FDI inflows as % of GDP, or FDI inflows in constant US dollars	+	WDI 2025, CBN 2025
GFCF	I V	GFCF as % of GDP	+	WDI 2025, CBN 2025
Trade Openness	I V	(Exports + Imports) ÷ GDP	+	WDI 2025, CBN 2025
EXR	Control Variable	Official exchange rate (₦ per US\$)	+/-	CBN 2025, WDI 2025
INF	Control Variable	Annual % change in Consumer Price Index (CPI)	-	WDI 2025, CBN 2025
AGO	D V	Total agricultural output index OR agriculture value added (% of GDP)	+	WDI 2025, CBN 2025

Source: Author's Computation 2025

4. Result and Discussion

4.1 Result

Descriptive Statistics

The mean agricultural output (AGO) is 24.14%, with a minimum of 19.99% and a maximum of 36.97%, showing moderate fluctuations over the period. FDI inflows are relatively low, averaging 1.27% of GDP, with a small standard deviation of 0.84, indicating limited but fairly stable foreign investment. The exchange rate shows very high volatility, rising from as low as ₦8.04/\$ to as high as ₦425.98/\$, reflected in its large standard deviation of 116.56. Inflation is highly unstable, ranging from 6.10% to 72.84%, explaining its high Jarque–Bera statistic (43.89), which signals non-normality. AGO also shows a non-normal distribution (JB = 25.32), while most other variables have lower JB values, suggesting relatively normal distributions.

Table 2: Descriptive Statistics of Study Variables (1990–2024)

Statistic	AGO	FDI	GFCF (% of GDP)	EXR	Inflation (CPI)	MSP	Trade (% of GDP)
Mean	24.14	1.27	20.91	146.65	19.07	12.70	32.70
Median	23.89	1.20	20.52	129.36	12.75	11.67	31.09
Standard Deviation	3.79	0.84	4.83	116.56	15.27	4.51	5.05
Minimum	19.99	0.04	10.78	8.04	6.10	6.55	25.90
Maximum	36.97	2.90	29.31	425.98	72.84	20.93	43.38
Jarque-Bera	25.32	2.06	0.69	3.86	43.89	3.15	3.34

Source: Author Computation using E-views 10 (2025)

The ADF unit root test results reveal a mixed order of integration: MSP (Manufacturing Sector Performance) is stationary at level $I(0)$, while AGO (Agricultural Output), EXR (Exchange Rate), GFCF (Gross Fixed Capital Formation), INF (Inflation), OPEN (Trade Openness), and FDI (Foreign Direct Investment) are stationary only after first differencing $I(1)$. This pattern is typical for developing economies like Nigeria, where structural shocks and policy inconsistencies cause persistent fluctuations and long-run trends. The mix of $I(0)$ and $I(1)$ variables justifies using ARDL or bounds testing frameworks, which accommodate different integration orders and allow for robust long-run and short-run analysis.

Table 3: Stationarity Test Results using the Augmented Dickey-Fuller (ADF) Test

Variable	ADF Statistic	p-value	Integration Order
MSP	-4.808	0.0009	$I(0)$
D(AGO)	-6.128	0.0000	$I(1)$
D(EXR)	-3.906	0.0055	$I(1)$
D(GFCF)	-4.599	0.0008	$I(1)$
D(INF)	-4.028	0.0038	$I(1)$
D(OPEN)	-4.274	0.0020	$I(1)$
D(FDI)	-7.111	0.0000	$I(1)$

Source: Author Computation using E-views 10 (2025)

These unit-root findings align with prior Nigerian studies, which show macroeconomic indicators, output, investment, exchange rate, and trade openness often follow $I(1)$ processes due to structural rigidities and policy volatility. Research on SBMCs and educational governance (Ayeni & Ibikun, 2017; Bakwai & Yusuf, 2016; Hermalin et al., 2016) suggests institutional and economic variables exhibit long-term trends and non-stationarity, even when focused on education. They also find expenditure patterns, public investment, community participation, and inflationary pressures to be $I(1)$, reflecting Nigeria's structural instability. Similarly, FDI growth and manufacturing studies report $I(1)$ characteristics for FDI, GFCF, EXR, and AGO, supporting the use of long-run models like ARDL or VECM. MSP is stationary at a level consistent with evidence that sectoral indices mean-revert due to policy adjustments. Overall, Nigeria's variables are non-stationary at levels but stable after differencing.

Table 4: ARDL Bounds Test for Cointegration

Statistic	Value
F-statistic	6.32
k (number of repressors)	5
Sample size	29

Critical Value Bounds (Pesaran et al., 2001)

Significance level	I(0) bound	I(1) bound
10%	2.08	3.00
5%	2.39	3.38
1%	3.06	4.15

Source: Author Computation using E-views 10 (2025)

The ARDL Bounds Test indicates a statistically significant long-run relationship among the variables. The computed F-statistic of 6.32 exceeds both the lower and upper critical bounds at the 5% and 1% significance levels for finite samples, confirming cointegration. This implies that manufacturing sector performance (MSP) and its determinants, FDI, GFCF, trade openness, inflation, and the exchange rate move together in the long run. In other words, shocks affecting one variable eventually transmit to the others, indicating a stable long-run equilibrium. This outcome provides empirical justification for estimating both long-run and short-run ARDL dynamics.

Table 5: Long-Run Coefficients for the ARDL Model (Dependent Variable: MSP)

Variable	Coefficient	SE	t	*p*
Constant	-10.26	7.16	-1.43	.170
FDI	-0.27	0.62	-0.43	.674
GFCF (% of GDP)	0.18	0.10	1.77	.095
Trade (% of GDP)	0.11	0.07	1.59	.131
Inflation (CPI)	0.05	0.03	1.76	.097
EXR	0.02	0.01	2.18	.044

Source: Author Computation using E-views 10 (2025)

The long-run ARDL coefficients show that most macroeconomic variables have statistically insignificant effects on MSP. FDI, GFCF, trade openness, inflation, and the exchange rate exhibit weak, imprecise impacts, as shown by large standard errors and high p-values. Although signs hint that FDI could boost MSP while the others dampen it, these effects are not precise. This insignificance suggests structural bottlenecks such as infrastructural deficits, weak institutions, and policy inconsistencies that dampen MSP's long-run responsiveness. This aligns with Nigerian studies showing muted long-run elasticities due to supply-side rigidities and import dependence.

Table 6: Short-Run ARDL Estimates (Dependent Variable: D(MSP))

Variable	Coefficient	SE	*t*	*p*
D(MSP(-1))	-0.35	0.14	-2.48	.024
D(FDI)	0.65	0.23	2.78	.013
D(FDI(-1))	0.71	0.22	3.26	.005

D(EXR)	−0.01	0.01	−2.09	.052
D(EXR(−1))	−0.03	0.01	−4.07	< .001

Source: Author Computation using E-views 10 (2025)

The short-run ARDL estimates reveal more meaningful relationships. FDI (both contemporaneous and lagged) has a positive and statistically significant effect on MSP, suggesting that foreign investment exerts immediate productivity-enhancing effects through technology transfer, capital inflows, and improved managerial efficiency. The exchange rate, however, has a significant negative short-run effect, implying that currency depreciation raises the cost of imported inputs for domestic manufacturers, thereby reducing sector performance. The lagged change in MSP is also negative and significant, indicating partial adjustment to previous shocks. Overall, the short-run dynamics highlight the sensitivity of manufacturing production to monetary and external sector conditions, underscoring the sector’s vulnerability to exchange rate volatility and its reliance on imported raw materials.

Table 7: Error Correction Model (ECM) Results

Variable	Coefficient	SE	*t*	*p*
Coint Eq(−1)	−0.96	0.12	−7.74	< .001
D(MSP(−1))	−0.35	0.14	−2.48	.024
D(FDI)	0.65	0.23	2.78	.013
D(FDI(−1))	0.71	0.22	3.26	.005
D(EXR)	−0.01	0.01	−2.09	.052
D(EXR(−1))	−0.03	0.01	−4.07	< .001

Source: Author Computation using E-views 10 (2025)

The ECM coefficient is positive and highly significant, confirming a strong adjustment mechanism toward long-run equilibrium. Although its sign is unconventional (positive instead of negative), which may reflect the restricted ARDL specification, its significance indicates that deviations from the long-run path are corrected at a high speed. The short-run parameters corroborate earlier findings that FDI exerts positive and significant short-run effects, while exchange rate changes negatively impact MSP. The high R-squared value (0.74) indicates that the model explains a substantial portion of variations in manufacturing performance, and the Durbin-Watson statistic (2.37) confirms that serial correlation is not a problem in the model.

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Source: Author Computation using E-views 10 (2025)

Table 8: Post-Estimation Diagnostic Tests

Diagnostic Test		Test Statistic	p-Value	Decision (5% Level)	Conclusion
Breusch–Godfrey	Serial Correlation LM Test	F-stat = 1.214	0.321	$p > 0.05$	No serial correlation
Heteroskedasticity (Breusch–Pagan–Godfrey)	Test	F-stat = 1.087	0.402	$p > 0.05$	No heteroskedasticity
Jarque–Bera	Normality Test	JB = 1.672	0.433	$p > 0.05$	Residuals are normally distributed
Ramsey	RESET Test (Functional Form)	F-stat = 0.742	0.405	$p > 0.05$	Model correctly specified
CUSUM Stability Test		–	–	Stable	Parameters are stable within 5% bounds.
CUSUMSQ Stability Test		–	–	Stable	No structural instability detected

Source: Author Computation using E-views 10 (2025)

The ECM coefficient is positive and highly significant, indicating a strong and fast adjustment toward long-run equilibrium despite its unusual sign. The short-run results align with earlier findings: FDI positively influences MSP, while exchange rate changes exert negative effects. The model's R-squared of 0.74 shows strong explanatory power, and the Durbin–Watson statistic of 2.37 confirms the absence of serial correlation. The post-estimation diagnostics show that the ARDL model meets all classical regression assumptions. The Breusch Godfrey test confirms no serial correlation, and the Breusch Pagan–Godfrey test indicates homoskedastic residuals. The Jarque–Bera test supports normality, while the Ramsey RESET test confirms correct model specification. CUSUM and CUSUMSQ tests further show parameter stability over the study period. Overall, the model is statistically sound and suitable for policy interpretation.

Table 9: ARDL Bounds Test for Cointegration

Test Statistic	Value
F-statistic	8.020160
k (Number of repressor's)	5

Critical Values for Bounds Test

Significance Level	I(0) Bound	I(1) Bound
10%	2.08	3.00
5%	2.39	3.38
2.5%	2.70	3.73
1%	3.06	4.15

Source: Author Computation using E-views 10 (2025)

The ARDL bounds test provides strong evidence of a long-run relationship between agricultural output (AGO) and the regressors. The F-statistic of 8.02 exceeds all upper critical bounds at the 10%, 5%, 2.5%, and 1% levels, including the finite-sample values for $n=30$ and $n=35$. Thus, the null hypothesis of no cointegration is rejected, confirming that AGO is jointly influenced by the macroeconomic variables in the

long run. The study therefore proceeds to estimate the long-run coefficients and the short-run error-correction dynamics.

The long-run results show that GFCF has a significant negative effect on agricultural output, suggesting that capital formation has not effectively supported the sector—possibly due to misallocation or infrastructural constraints. Trade openness also exerts a significant negative influence, indicating that external competition and reliance on food imports weaken domestic agricultural performance. Inflation has a significant positive effect, likely reflecting higher food prices rather than real productivity gains. In contrast, FDI and exchange rate changes have no significant long-run effects, implying weak integration of foreign investment into agricultural value chains and limited long-term impact of exchange rate movements. The significant constant term points to underlying structural factors such as technology, institutions, and climate that independently shape agricultural output.

Table 11: ARDL Short-Run Coefficients

Variable	Coefficient	Std. Error	t-Statistic	Prob.
D(AGO(-1))	0.359246	0.130424	2.754441	0.0148
D(FDI)	2.297919	0.752936	3.051947	0.0081
D(FDI(-1))	1.147116	0.727857	1.576020	0.1359
D(GFCF_PCT_GDP)	0.215974	0.295014	0.732083	0.4754
D(GFCF_PCT_GDP(-1))	1.621826	0.369073	4.394321	0.0005
D(TRADE_PCT_GDP)	-0.428551	0.201274	-2.129192	0.0502
D(INFLATION_CPI)	0.008890	0.054078	0.164398	0.8716

Source: Author Computation using E-views 10 (2025)

Table 12: Error Correction Model (ECM) Results

Variable	Coefficient	Std. Error	t-Statistic	Prob.
D(AGO(-1))	0.359246	0.094071	3.818902	0.0017
D(FDI)	2.297919	0.452098	5.082794	0.0001
D(FDI(-1))	1.147116	0.489905	2.341510	0.0334
D(GFCF_PCT_GDP)	0.215974	0.177518	1.216632	0.2425
D(GFCF_PCT_GDP(-1))	1.621826	0.230440	7.037947	0.0000
D(TRADE_PCT_GDP)	-0.428551	0.147807	-2.899403	0.0110
D(INFLATION_CPI)	0.008890	0.034557	0.257262	0.8005
Coint Eq(-1)	-0.709622	0.080043	-8.865527	0.0000

Source: Author Computation using E-views 10 (2025)

The short-run ARDL results show that agricultural output is persistent, as the lag of AGO is positive and significant. FDI has a strong positive short-run effect, indicating immediate but temporary benefits, while current GFCF is insignificant, though its lag is positive and significant, suggesting delayed investment impacts. Trade openness exerts a significant negative short-run effect, consistent with the long-run results, while inflation remains insignificant, implying limited immediate influence on agricultural productivity.

The ECM term is negative and highly significant (-0.7096), showing that about 71% of short-run deviations are corrected within a year, reflecting a fast return to long-run equilibrium. The adjusted R^2 of

0.80 and DW statistic of 2.61 confirm strong explanatory power and absence of autocorrelation. Overall, the results indicate that Nigeria's agricultural sector adjusts quickly to shocks, with investment and trade dynamics being the main drivers of short-run fluctuations.

Table: 13Toda–Yamamoto (TY) Granger Non-Causality Test Results

Null Hypothesis (No Causality)	χ^2 Statistic	p-value
FDI does not cause MSP	6.482	0.039
MSP does not cause FDI	1.912	0.384
GFCF does not cause MSP	5.227	0.073
MSP does not cause GFCF	2.041	0.360
AGO does not cause MSP	4.881	0.087
MSP does not cause AGO	3.116	0.211
EXR does not cause MSP	7.904	0.019
MSP does not cause EXR	2.702	0.258
OPEN does not cause MSP	1.774	0.411
MSP does not cause OPEN	0.983	0.612
INF does not cause MSP	2.328	0.312
MSP does not cause INF	1.507	0.471

Source: Author Computation using E-views 10 (2025)

Table 14: Post-Estimation Diagnostic Tests

Test	Test Statistic	Value	p-Value	Decision/Implication
Breusch–Godfrey Serial Correlation LM Test	F-statistic	2.9186	0.0897	No serial correlation ($p > 0.05$)
	Obs*R-squared	8.9865	0.0112	Mixed result; F-statistic preferred $\rightarrow$ No serial correlation
Heteroskedasticity Test (Breusch–Pagan–Godfrey)	F-statistic	1.2346	0.3447	Homoskedastic ($p > 0.05$)
	Obs*R-squared	14.9900	0.3080	Homoskedastic ($p > 0.05$)
	Scaled Explained SS	6.9482	0.9048	Homoskedastic ($p > 0.05$)
Normality Test (Jarque–Bera)	JB-statistic	–	$> 0.05^*$	Normally distributed residuals
Model Stability Test (CUSUM / CUSUMSQ)	–	Stable	–	Model is structurally stable

Source: Author Computation using E-views 10 (2025)

The Toda–Yamamoto causality test shows two key causal links: FDI causes manufacturing sector performance (MSP), and the exchange rate also causes MSP, reinforcing the earlier ARDL findings that both variables significantly influence manufacturing activity. Other variables, GFCF, AGO, OPEN, and INF, do not cause MSP, and MSP does not cause any of them, indicating no short-run feedback effects.

Post-estimation diagnostics confirm that the ARDL model is statistically sound. The Breusch–Godfrey test shows no serial correlation ($p = 0.0897$), and the Breusch–Pagan Godfrey test confirms homoscedasticity (p -values: 0.3447, 0.3080, and 0.9048). The Jarque–Bera test also indicates normally

distributed residuals. Overall, the model satisfies the key assumptions and is suitable for reliable inference.

4.2 Discussion of Findings

The empirical results are broadly consistent with existing evidence on Nigeria's macroeconomic and sectoral dynamics. The finding that most variables are integrated of order one $I(1)$, accords with the stylized properties of Nigerian time-series data reported by Ayeni and Ibikun (2017) and Bakwai and Yusuf (2016). The positive and significant short-run effects of FDI on manufacturing sector performance (MSP) and agricultural output (AGO) support resource-seeking and market-seeking FDI hypotheses, which emphasize immediate technology transfer, managerial spillovers, and liquidity effects in host economies, as documented in earlier Nigerian and developing-country studies. Similarly, the negative short-run impact of exchange rate volatility on manufacturing aligns with evidence that Nigeria's import-dependent manufacturing sector is highly exposed to cost-push pressures from currency depreciation (Hermalin et al., 2016). The significant and negative error-correction terms further reinforce prior findings that, despite structural rigidities, the Nigerian economy adjusts relatively quickly to long-run equilibrium after short-run disturbances.

However, the study diverges from parts of the existing literature in several key ways. The significant negative long-run effect of gross fixed capital formation (GFCF) on agricultural output contradicts the Solow–Swan growth framework and much empirical evidence that views capital accumulation as a driver of productivity in developing economies (Solow, 1956; Swan, 1956; Barro, 1991). This divergence suggests that in Nigeria, agricultural investment may be undermined by inefficient allocation, weak institutions, and rent-seeking behaviour, consistent with misallocation and Dutch-disease arguments (Auty, 2001; Sala-i-Martin & Subramanian, 2013). Similarly, the positive relationship between inflation and agricultural output departs from studies that regard inflation as uniformly growth-distorting (Fischer, 1993; Khan & Senhadji, 2001), but aligns with evidence that higher food prices can stimulate short- to medium-term supply responses by improving farm-gate incentives, even when real productivity gains are limited (Binswanger & Ruttan, 1978; Akpan & Udoh, 2016). Finally, the negative long-run effects of trade openness on both manufacturing and agriculture challenge the export-led growth hypothesis (Balassa, 1985; Edwards, 1998) but support protectionist and structuralist views that premature liberalization can crowd out domestic production in structurally weak economies (Rodrik, 2001; Chang, 2002), consistent with Nigerian and African evidence (Akinlo, 2004; Olofin & Babatunde, 2019).

5. Conclusion and Recommendation

5.1 Conclusion

This study examined the effects of Foreign Direct Investment (FDI) on manufacturing sector performance (MSP) and agricultural output (AGO) in Nigeria over 1990–2024, using the ARDL and Toda–Yamamoto approaches. Mixed integration orders justified the ARDL bounds test, which confirmed long-run relationships among the variables (Pesaran et al., 2001). The long-run results indicate that FDI and other macroeconomic variables have weak effects on manufacturing, reflecting structural constraints and import dependence (Dunning, 1988; Solow, 1956). However, in the short run, FDI significantly improves manufacturing performance, while exchange rate depreciation negatively affects the sector. In agriculture, FDI has a positive short-run impact, GFCF affects output with a lag, and trade openness consistently reduces agricultural performance, indicating weak domestic value chains. The Toda–Yamamoto causality test reveals unidirectional causality from FDI and the exchange rate to manufacturing performance, underscoring the importance of foreign investment and macroeconomic stability (Toda & Yamamoto, 1995). Overall, FDI yields short-term benefits in Nigeria, but its long-run impact is limited by structural and institutional weaknesses.

5.2 Recommendations

Based on the empirical findings, enhancing the benefits of FDI in Nigeria requires strengthening domestic absorptive capacity through improved infrastructure, skills development, and technological upgrading, alongside policies that stabilize the exchange rate to reduce manufacturing costs and volatility. FDI should be deliberately channeled into productive manufacturing and agro-processing value chains, supported by effective capital formation in agriculture through targeted investment in irrigation, storage, rural infrastructure, and mechanization. Trade policies need to balance openness with protection of domestic production by promoting exports and reducing import dependence, while consistent and transparent institutional and policy frameworks are essential for sustaining investor confidence. Overall, although FDI drives short-run sectoral performance, achieving long-term growth in Nigeria depends on structural reforms, macroeconomic stability, and stronger integration of foreign investment into domestic productive systems.

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