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Foreign Direct Investment, Capital Flows, and Sectoral Growth in Nigeria: A Comparative Analysis of Agriculture and Manufacturing

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Abstract: The nexus between the agricultural sector, manufacturing sector, and FDI has been a topic of debate over the years. While the fundamental role of FDI in the growth of the overall economy has been widely recognized, findings of existing literature have remained unclear and inconclusive on how the impact of FDI varies across these distinct sectors, especially within the context of developing countries like Nigeria. This study aims to provide a comprehensive comparative analysis of the impact of FDI and other capital inflows on Nigeria's agricultural and manufacturing sectors between 1980 and 2021. Using annual time-series data from the World Bank's World Development Indicators (WDI) and the Central Bank of Nigeria (CBN), the study employs the Autoregressive Distributed Lag (ARDL) modelling approach. Four sector-specific ARDL models were specified, each subjected to extensive diagnostic and robustness checks to ensure the reliability of the estimates. The findings reveal a contrasting effect: while FDI exerts no statistically significant influence on manufacturing output, it has a strong and transformative impact on agricultural performance. In addition, other capital inflows, including official development assistance, development finance, and remittances, were found to significantly influence both sectors. The study concludes that FDI is not a universal driver of growth, and its effectiveness depends on sectoral characteristics, investment type, and policy environment. It contributes to the literature by offering one of the first sector-specific comparative analyses of capital flows in Nigeria, providing evidence to guide policies aimed at shifting the economy from consumption-driven patterns toward sustainable, production-oriented growth.

Keywords: Foreign Direct Investment (FDI), Capital Flows, Agricultural Sector, Manufacturing Sector, Economic Growth, ARDL Model

JEL Codes: F21, F32, Q10 and L60

1. Introduction

International trade, largely facilitated by multinational corporations (MNCs), has long been regarded as a veritable force in promoting global interconnectedness (Anowor, Ukweni, Ibiam & Ezekwem, 2013). In this context, countries have increasingly opened their economies to foreign participation, enabling external firms to establish plants, transfer technology, and contribute to large-scale production. Among the key drivers of this process is Foreign Direct Investment (FDI), which is widely recognized as a modern instrument for enhancing local production capacity, technological transfer, and managerial expertise. As Anshu (2013) notes, many countries have adopted policies that attract FDI, thereby introducing high-tech machinery, substantial financing, advanced marketing strategies, and professional management skills to domestic industries.

The global trajectory of FDI underscores its immense potential. According to the United Nations Conference on Trade and Development (UNCTAD, 2017), Africa recorded FDI inflows worth over $1.3 trillion in 2006, representing more than a 100% increase from $9.6 billion just six years earlier. Despite this, flows to Africa's largest economies remain highly inconsistent. For instance, FDI inflows to Nigeria fell sharply by 68% in 2018 to just $0.78 billion, before rebounding in subsequent years. These fluctuations were particularly visible during Nigeria's 2016 recession and the global COVID-19 pandemic in 2020. South Africa experienced similar volatility, with inflows declining from $5.57 billion in 2018 to $3.15 billion in 2020 (World Bank, 2021). Such inconsistencies have intensified scholarly interest in examining the actual benefits of FDI.

While a substantial body of literature has explored the relationship between FDI and economic development, the findings remain controversial and inconclusive. Much of this research focuses on the manufacturing sector, which is often considered the engine of modern economic growth (Orji et al, 2015). For example, Sani et al. (2021) and Yaya et al. (2022), employing the ARDL approach, found a significant positive impact of FDI and other capital inflows on Nigeria's manufacturing sector. Similar evidence is reported in other regions; Azolibe (2021) confirmed the positive role of inward FDI on manufacturing growth in the MENA region, while Niharika and Seema (2023) observed a comparable relationship in India, highlighting the role of technology spillovers.

Conversely, other studies present a more nuanced perspective. Ajide et al. (2022), for instance, found that the shadow economy exerts a negative short-run effect on FDI inflows into Nigeria's manufacturing sector, although the long-run effect remains positive. In addition

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some scholars report that FDI has no statistically significant effect on manufacturing output. These divergent findings highlight the unresolved debate regarding the role of FDI in industrial development.

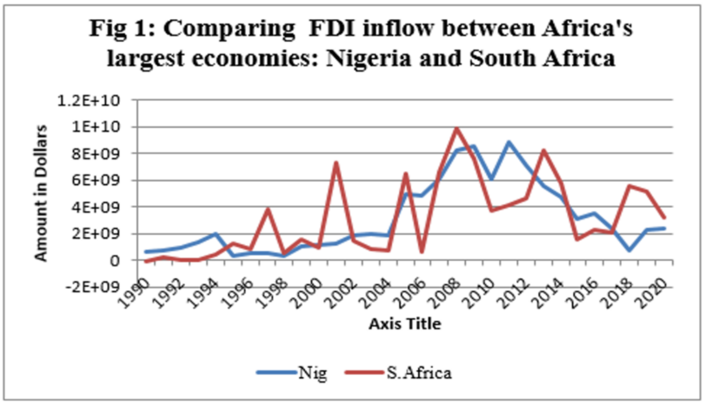

Figure 1: Comparing FDI inflow between Africa's largest economies: Nigeria and South Africa

Source: Author's Computation using World Development Indicators (WDI, 2021)

The agricultural sector reflects a similar level of ambiguity, though it has attracted less research attention. Studies such as Zeytoonnejad Mousavian et al. (2023), Orji et al (2014), and Tian (2023) identify determinants of agricultural FDI, including market size, economic growth, and other capital flows such as Official Development Assistance (ODA). However, the evidence on production effects is mixed. Some works suggest that FDI enhances agricultural output and competitiveness: Kastratović (2023) reported positive effects on agricultural exports in developing countries, while Ananwude et al. (2025) found significant benefits across Nigeria's crop and livestock sub-sectors, characterizing FDI as a "panacea" for growth. In contrast, Ognaje and Salami (2022) showed a statistically significant negative long-run effect of FDI on Nigeria's agricultural GDP, a finding consistent with Han et al. (2024), who argued that FDI spillovers can act as a "two-edged sword," simultaneously benefiting some firms while disadvantaging others.

These conflicting results underscore that the benefits of FDI remain unsettled, particularly within Nigeria. While one recent study by Adeagbo and Jimoh (2023) attempted a comparative analysis, their conclusion, that FDI exerts no significant effect on either agriculture or manufacturing, further illustrates the lack of consensus.

From the above, two key gaps are evident. First, existing studies tend to focus on either the manufacturing sector or the agricultural sector in isolation, with very limited comparative analyses of how FDI affects both sectors simultaneously. Second, most prior research does not adequately incorporate other capital flows, such as remittances, development finance, and official development assistance, into the analysis, even though these flows often complement or substitute for FDI in shaping sectoral performance.

This study addresses these gaps by providing a comparative, sector-specific analysis of the impact of FDI and other capital inflows on Nigeria's manufacturing and agricultural sectors. By employing the Autoregressive Distributed Lag (ARDL) modeling framework, the paper not only disentangles the distinct short- and long-run dynamics of capital flows but also provides a more holistic understanding of their effects. The novelty of this study lies in its simultaneous examination of multiple forms of capital across two critical sectors, thereby offering deeper insights into the heterogeneous role of foreign capital in Nigeria's economic development.

2. Methodology

2.1. Theoretical Framework

The objectives of this study are addressed empirically using a dynamic estimation approach. The analysis is grounded in Jorgenson's theory of investment, which is based on the determination of the optimal capital stock. The theory derives from the firm's profit maximization framework and rests on several assumptions: firms operate in perfectly competitive markets, there is no uncertainty, capital is fully utilized without adjustment costs, and firms maximize profits not only in the current period but across their entire lifetime with perfect foresight of future values.

In essence, Jorgenson's theory compares two alternative continuous paths of capital accumulation, both of which depend on the time profile of interest rates, and posits that the investment demand is strongly influenced by the cost of capital. Building on this foundation, the present study extends the theory by examining how different forms of capital inflows, specifically Foreign Direct Investment (FDI) and other external capital sources, affect firms' ability to finance their optimal capital stock. In addition, domestic credit, particularly commercial bank loans, is incorporated as a key determinant of the user cost of capital in both the manufacturing and agricultural sectors.

To achieve the study's empirical objectives, we adopt the Autoregressive Distributed Lag (ARDL) model developed by Pesaran et al. (2001). The ARDL framework is particularly appropriate because it is highly flexible, accommodates a mixture of stationary [I(0)] and first-differenced [I(1)] variables, and progresses systematically from the general to the specific. As noted by Ghouse et al. (2018), this dynamic model effectively addresses several econometric challenges, thereby yielding more reliable and robust results.

The general ARDL(p,q) representation is given as:

$$\pi(l)y_t = \varphi + \rho_1(l)x_{1t} + \rho_2(l)x_{2t} + \rho_k(l)x_{kt} + \varepsilon_t \dots\dots\dots\dots\dots\dots\dots\dots\dots\dots\dots\dots\dots. eqn\ 1$$

With the condition that the error term (ε_t) is white noise ($\varepsilon_t \sim iid(0, \delta^2)$), Equation 3.1 can be analyzed using a Z sample of observations and $Z - \max(1,1)$. Alternatively, that ε_t is stationary and at the same time independent of y_t, y_{t-1}, x_t andx_{t-1}.

2.2. Model Specification

As was already said, this study expands upon Jorgenson's investment hypothesis. Based on the literature, this theoretical construct has been enhanced and adjusted to include foreign direct investment and other control variables. The dependent variables are MFG – manufacturing sector output, AG – Agricultural sector output. The explanatory variables are FDI – foreign direct investment, GCF – gross capital formation, INT – interest rate, CBLM – commercial bank loan to manufacturing sector, CBLAG – commercial bank loan to agricultural sector, REM – remittance, ODA – official development assistance, TRG – trade globalisation, EXR – exchange rate. As previously indicated, the ARDL estimation is used in this work to achieve its objectives. The ARDL models used in this study are as follows:

The model for objective 1

$$\Delta lnMFG_t = \beta_0 + \beta_1 lnMFG_{t-1} + \beta_2 FDI_{t-1} + \beta_3 GCF_{t-1} + \beta_4 INT_{t-1} + \beta_5 CBLM_{t-1} + \beta_6 LP_{t-1} + \sum_{i=1}^{p} \gamma_i \Delta\, lnMFG_{t-i} + \sum_{i=1}^{q} \delta_i \Delta\, FDI + \sum_{i=1}^{q} \varphi_i \Delta\, INT_{t-i} + \sum_{i=1}^{q} \theta_i \Delta\, CBLM_{t-i} + \sum_{i=1}^{q} \vartheta_i \Delta\, LP_{t-i} + \varepsilon_t \ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots .2$$

The model for objective 2

$$\Delta lnAG_t = \beta_0 + \beta_1 lnAG_{t-1} + \beta_2 FDI_{t-1} + \beta_3 GCF_{t-1} + \beta_4 INT_{t-1} + \beta_5 CBLAG_{t-1} + \beta_6 LP_{t-1} + \sum_{i=1}^{p} \gamma_i \Delta\, lnMFG_{t-i} + \sum_{i=1}^{q} \delta_i \Delta\, FDI + \sum_{i=1}^{q} \varphi_i \Delta\, INT_{t-i} + \sum_{i=1}^{q} \theta_i \Delta\, CBLAG_{t-i} + \sum_{i=1}^{q} \vartheta_i \Delta\, LP_{t-i} + \varepsilon_t \ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots .3$$

The model for objective 3

$$\Delta lnMFG_t = \beta_0 + \beta_1 lnMFG_{t-1} + \beta_2 REM_{t-1} + \beta_3 ODA_{t-1} + \beta_4 TRG_{t-1} + \beta_5 EXR_{t-1} + \beta_6 CMLM_{t-1} + \sum_{i=1}^{p} \gamma_i \Delta\, lnMFG_{t-i} + \sum_{i=1}^{q} \delta_i \Delta\, FDI + \sum_{i=1}^{q} \varphi_i \Delta\, INT_{t-i} + \sum_{i=1}^{q} \theta_i \Delta\, CBLM_{t-i} + \sum_{i=1}^{q} \vartheta_i \Delta\, LP_{t-i} + \varepsilon_t \ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots .4$$

The model for objective 4

$$\Delta lnAG_t = \beta_0 + \beta_1 lnAG_{t-1} + \beta_2 REM_{t-1} + \beta_3 ODA_{t-1} + \beta_4 TRG_{t-1} + \beta_5 EXR_{t-1} + \beta_6 CMLM_{t-1} + \sum_{i=1}^{p} \gamma_i \Delta\, lnMFG_{t-i} + \sum_{i=1}^{q} \delta_i \Delta\, FDI + \sum_{i=1}^{q} \varphi_i \Delta\, INT_{t-i} + \sum_{i=1}^{q} \theta_i \Delta\, CBLAG_{t-i} + \sum_{i=1}^{q} \vartheta_i \Delta\, LP_{t-i} + \varepsilon_t \ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots .5$$

The aforementioned models support the short- and long-term associations while maintaining the pre-described characteristics of the variables. The following list represents the ARDL models' order: (p, q). Time and lags, respectively, are denoted by the subscripts i and t. The well-behaved error term is ε_t. The ARDL limits test, which is a new technique for determining the cointegration/long-run connection among variables, was created by Pesaran et al. (2001) and is used in the models mentioned above. The F-statistics run the ARDL limits test twice to determine the significance of the delayed coefficients. It is believed that the ARDL is still effective with little sample data.

The F-statistic or Wald test is used in the first step of ARDL bounds testing to determine the long-term relationship between the variables. The Wald test involves setting the coefficients of all lag variables in the aforementioned models to zero. The bounds test's values from Pesaran et al. (2001) tables with upper and lower bounds at 1%, 5%, and 10% levels of significance are compared to the model's calculated F-statistic.

If the estimated F-statistic is more than the critical values, the null hypothesis (H_0) of "no cointegration" is dismissed. When the projected F-statistic value is in the range between the upper and lower boundaries, the cointegration determination is rendered uncertain. If the F-statistic is below the top and lower boundaries, however, the null hypothesis that there is no cointegration is not ruled out. The next step is to estimate the elasticity of the long and short run connections based on the findings in order to determine the effect of the right-hand variables on the dependent variable. Before calculating the elasticity of the long-term connection, we must first establish the long-term relationships between the variables. On the other side, the short-run coefficients of the differenced variables are used to estimate the short-run elasticity.

If the short-run coefficient is greater than one, the Wald test is employed to evaluate whether they are jointly significant in the long run. For any short-term disequilibrium, the error correction term (ECT) coefficients in the models must be negatively signed, significant, and have a value between 0 and 1, suggesting convergence to the long-run equilibrium.

The requirement is that the ARDL method be applied so far, the series are integrated at level (i.e., I (0)), integrated of order one (i.e., I (1)), or integrated of both orders. As with previous cointegration testing procedures, ensuring that this condition is true can help ease the strain of attempting to divide the model's variables into I (0) and I (1). The ARDL technique works in any order of integration except I (2).

3. Results And Discussions

3.1. Test of Unit Root

To test if the mean and variance of the variables do not change with time, we adopt the Augmented Dickey-Fuller (ADF) test of unit root, as displayed in the table below:

Table 1: ADF Unit Root Test Results

Variable	ADF Test Stat at Level	5% Critical Value	ADF Test Stat at 1st Diff	5% Critical Value	Order of Integration
MFG	0.527215	-2.943427	-5.139759	-2.943427	I(1)
AG	0.042756	-2.938987	-4.406113	-2.938987	I(1)
FDI	-2.034429	-2.943427	-2.083047	-1.950117	I(1)
GCF	0.204109	-2.943427	-4.270839	-2.943427	I(1)
INT	-2.390021	-2.936942	-5.425798	-2.941145	I(1)
CBLMF	1.866808	-2.960411	-3.813246	-3.533083	I(0)
LP	-0.242675	-2.938987	-3.748365	-3.529758	I(1)

Variable	ADF Test Stat at Level	5% Critical Value	ADF Test Stat at 1st Diff	5% Critical Value	Order of Integration
CBLAG	5.722855	-2.936942	-3.888499	-3.529758	I(0)
REM	-0.677982	-2.936942	-3.949239	-3.529758	I(1)
ODA	-3.325481	-2.936942	-6.312719	-3.533083	I(0)
TRG	-2.795527	-2.936942	-6.558419	-3.529758	I(1)
EXR	2.250159	-2.936942	-4.778466	-3.529758	I(1)

Source: Calculated by the Authors

According to the ADF test statistic and t-statistic findings for the unit root test, which are shown in Table 1 shows that all the variables lack unit roots, particularly at the first difference. The variables became stationary at their first difference, with the exception of CBLMF, CBLAG, and ODA, which are stationary at their level form. This result aligns with the criteria for applying the ARDL estimation method.

3.1.1. Findings From The Estimated ARDL Models

Considering that the variables are stationary and the order of integration meets the criteria for estimating an ARDL model, the model was estimated accordingly. In this section, the findings are discussed following the presentation of results in Table 2. Statistical significance is assessed at the 1%, 5%, and 10% levels, as reported in the fifth column (Prob.*) of the table.

Table 2: Results on the impact of FDI on manufacturing sector output

	Dependent Variable: LOG(MFG)			
Regressors	**Coefficient**	**Std. Error**	**t-Statistic**	**Prob.***
LOG (MFG (-1))	0.072213	0.066585	1.084526	0.286
LOG(FDI)	0.041314	0.022949	1.800236	0.081
LOG(GCF)	0.572462	0.054831	10.44***	0
INT	-0.016852	0.006271	-2.6874**	0.0112
LOG(CBLMF)	0.033986	0.016636	2.0429**	0.0491
LOG(LP)	1.034863	0.219101	4.723***	0
CONSTANT	2.576608	1.388532	1.855634	0.0725
R-squared	0.876591	Durbin-Watson stat		1.256813
Adj. R-squared	0.872335	F-stat		229.4562
Prob(F-stat)	0.00000			

*Source: Calculated by the Authors, *** significant at 1%, **5%, *10%*

According to the estimated ARDL model, the R-squared value of 0.8765 indicates that the independent variables explain about 87% of the variation in the dependent variable. The F-statistic of 229.4562, with a probability value of 0.0000, confirms the overall statistical significance of the model.

The estimation results reveal that the coefficient of FDI is not statistically significant at the 5% level, though it is positively signed. This suggests that the Nigerian manufacturing sector is not benefiting from FDI. Such an outcome runs contrary to a priori expectations, as FDI is typically associated with positive spillovers such as financial inflows, technology transfer, human resource development, enhanced competitiveness, and supplementary capital to offset domestic shortfalls. However, this does not appear to be the case for Nigeria's secondary sector. The lack of significant impact may be explained by the historical bias of FDI toward extractive industries, as highlighted by Adeagbo and Jimoh (2023). Combined with a hostile business environment, characterized by weak socioeconomic and political conditions, this has discouraged investment in the manufacturing sector (Ajide et al., 2022). While these findings contradict Nigerian studies reporting a positive relationship between FDI and manufacturing (Sani et al., 2021; Yaya et al., 2022), they are consistent with others that found no significant impact (Adeagbo & Jimoh, 2023). The sector's low absorptive capacity and high operational costs make it difficult to harness the potential spillovers that FDI has delivered in other economies (Han et al., 2024).

Gross capital formation (GCF), by contrast, has a statistically significant coefficient of 0.5724, underscoring its importance to the performance of Nigeria's manufacturing sector. Capital formation is widely regarded as a driver of growth and development, as it determines an economy's capacity to produce. Owolabo and Ajayi (2013) emphasized that deficiencies in capital formation seriously constrain the productive sector. The Big Push theory of the 1970s similarly argued that large-scale investments in infrastructure are necessary to propel countries out of low-productivity traps. Encouragingly, the findings here confirm the significance of capital formation in Nigeria, making it imperative for the government and relevant authorities to harness its potential benefits.

The statistically significant negative coefficient of -0.0168 on the interest rate (INT) indicates that the rates charged by Nigerian money deposit banks are excessively high. Rather than encouraging private investment in manufacturing, such high borrowing costs yield suboptimal outcomes and crowd out domestic investment. This aligns with economic theory, which holds that high interest rates discourage investment. Ouedraogo, Tabi, and Ondoa (2020), among others, also identified interest rates as a significant determinant of manufacturing sector performance.

Finally, the positive and significant coefficients of both commercial bank loans to the manufacturing sector (CBLMF) and labor productivity (LP) confirm their crucial role as drivers of manufacturing output. These results reinforce the argument that strong domestic financial intermediation and a skilled workforce are essential to leveraging opportunities for growth in the real sector.

Table 3: The Bounds Cointegration Test

Level of significance	Lower bound	Upper bound
10%	2.08	3
5%	2.39	3.38
1%	3.06	4.15

Source: Author Computation, F-statistic calculated: 56.84; K=5. (Significant at 10%, 5%, and 1% significance levels, with *critical values of 2.08, 2.39, and 3.06 as lower bound values and 3, 3.38, and 4.15 as upper bound values). The critical values are taken from Narayan's (2005) critical table.*

Table 3 displays the results of the ARDL bounds test for cointegration. The study used the bound test, as described above, to determine if there is a long-run association between the variables. The F-statistic value is approximated to be 56.84. "K" represents the number of parameters, which in this case is 5. Because the F-statistic surpasses the lower and upper bound values of 2.08 and 3.38 at the 5% level of significance, the conclusion is that there is a long-run relationship; hence, the short-run dynamics need to be estimated.

Table 4: ARDL Short-run Error Correction Regression

Dependent Variable: DLOG(MFG)				
Regressors	**Coefficient**	**Std. Error**	**t-Statistic**	**Prob.**
ECT (-1)	-0.772213	0.049444	-21.68***	0.0000
R-squared	0.921252			
Adj. R-squared	0.921252			
Durbin-Watson stat	1.256813			

*Source: Calculated by the Author. *** significant at 1%, **5%, *10%*

Table 4 displays the immediate dynamics from the estimated long-run ARDL model. The first column contains the regressors and ECT, the second, the short-run coefficients of the independent variables demonstrating the magnitude of impacts on the dependent variables and ECT, the third, the standard errors, the fourth, the t-statistic demonstrating the level of significance for each independent variable and the ECT, and the fifth, the probability values.

The error correction model's (ECM) R-squared value is 0.9212, which indicates that the independent variables explain nearly 92% of the variance in the dependent variable, indicating that the model fits the data well. The ECT coefficient, which is -0.7722 and statistically significant at the 5% level of significance, suggests that the variables converge to their long-run equilibrium after enduring short-term disequilibrium, according to the estimation. The ECT demonstrates that in the near run, yearly adjustments are made to account for around 77% of the variable disequilibrium. The outcome also implies that, given the rapid rate of adjustment, the impact of foreign trade policy may be immediate.

3.1.2. Post Estimation Diagnostic Tests

Table 5: Autocorrelation test and Heteroskedasticity Test: Breusch-Pagan-Godfrey

	Obs*R-squared	**Prob. Chi-Square (2) and (15)**
Breusch-Godfrey Serial Correlation LM Test	2.882681	0.3101
Heteroskedasticity Test: Breusch-Pagan-Godfrey	36.46109	0.1014

Source: Calculated by the Authors

The serial/autocorrelation and heteroskedasticity post-estimation diagnostic tests for model 1 are shown in Table 5. These tests' null hypotheses are presented in a way that is acceptable. H0: No autocorrelation is the null hypothesis for autocorrelation, while H0 is the null hypothesis for heteroscedasticity. H0: Homoscedastic residuals. The probability value of the Observed R-Squared for each test must be larger than the 5% level of significance in order to accept these null hypotheses and draw the conclusion that the models are free of autocorrelation and heteroscedasticity issues.

The null hypothesis is rejected based on the following and the findings in the tables above, which show that the results from the calculated ARDL models are free of autocorrelation and heteroscedasticity. The observed *R-squared probability values of 20% and 10%, respectively, are greater than the 5% level of significance. Simply expressed, this demonstrates that the model's estimates may be relied on for economic assessments and forecasts.

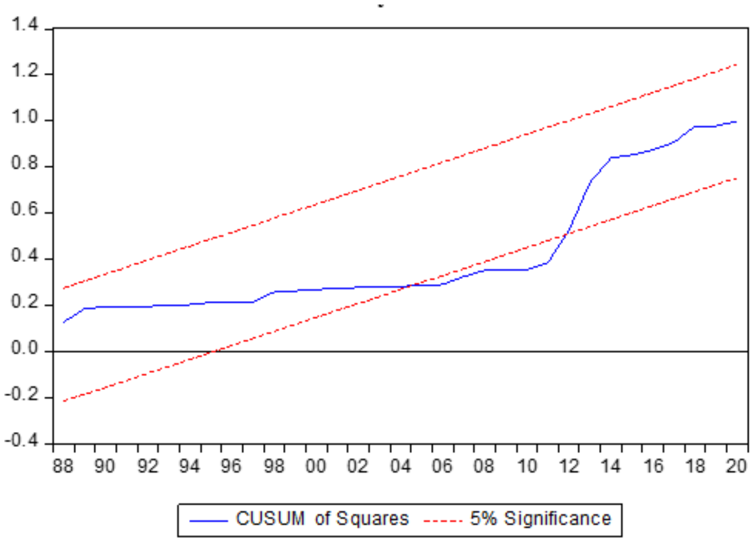

Figure 2: CUSUM Test of Model Stability

Figure 2 is a diagnostic test for post-estimation adopted to determine the model's stability. If the blue line (i.e., CUSUM of squares) remains within two red lines (5% significance), this means that the model has passed the stability test, as shown in the figure above. As a result, we infer that the estimated model's coefficients are stable.

3.1.3. Results Of The ARDL Model For Objective 2

Table 6: Impact of FDI on agricultural sector output

Dependent Variable: LOG(AG)				
Regressors	**Coefficient**	**Std. Error**	**t-Statistic**	**Prob.***
LOG (AG (-1))	0.444355	0.126076	3.524***	0.0013
LOG(FDI)	0.120422	0.035015	3.439***	0.0016
LOG(GCF)	0.421187	0.083006	5.074***	0.0000
INT	-0.013437	0.009085	-1.479031	0.1486
LOG(CBLAG)	0.165433	0.030179	5.481***	0.0000
LOG(LP)	-0.365635	0.312927	-1.168434	0.2510
CONSTANT	3.670566	1.895621	1.936339	0.0614
R-squared	0.879342	Durbin-Watson stat		2.037528
Adjusted R-squared	0.865585			
F-statistic	260.7349			
Prob(F-statistic)	0.000000			

*Source: Calculated by the Authors. *** significant at 1%, **5%, *10%*

The estimated ARDL model's findings about the effect of FDI on the output of the agriculture sector in Nigeria are shown in Table 6 above. According to the estimation, the coefficient of past agricultural sector output values (AG (-1)) is 0.444, statistically significant at the 5% level. This suggests that, when other variables are held constant, an increase in past agricultural sector output of 1% typically results in a 0.444% increase in current period values in Nigeria. This result meets a priori expectations since, according to economic theory, economic indicators' historical values tend to have an impact on their current values. The aforementioned outcome is in line with research by Debi et al. (2016), as well as Behun et al. (2018).

Furthermore, the coefficient of FDI (0.1204) is positive and statistically significant at the significance level, implying that Nigeria's agriculture sector can gain from foreign investment inflows. This result suggests that, holding other variables constant, and on average, the more the Nigerian economy creates a favourable investment environment for foreign investment, the more the agricultural sector benefits from the positive spill-over and output increases by approximately 0.1204%. FDI is considered critical for the promotion of agricultural sector raw materials in developing countries such as Nigeria; it can serve as a catalyst for agricultural sector output growth as well as an opportunity for developing a country's integration into global capital flows and export bases while generating technological capability building and efficiency spillovers to domestic firms. FDI provides an investment arrangement that boosts the potential and capability for increasing the agricultural sector output (Edeh, Eze, & Ugwuanyi, 2020). This outcome is consistent with research by Ananwude et al. (2025) and Kastratović (2023), who found that FDI has a significant positive impact on agricultural output in developing countries. Our finding is particularly important within the Nigerian context, where previous studies have yielded conflicting results, with some finding a negative impact of FDI on agriculture (Ognaje & Salami, 2022). The positive effect may be driven by the fact that FDI in this sector is often geared towards large-scale, commercial farming that is better equipped to navigate Nigeria's challenging business environment and exploit its vast, underutilized arable land.

In the same vein, the result of the estimated model in Table 3.2.1 reveals that the coefficient of gross capital formation (GCF) is 0.4211 and statistically significant at 5% level of significance. This underscores the role of capital in driving agricultural output. The results confirm a fundamental principle of development economics: investment, whether through direct capital formation or financial intermediation, is essential for transforming a sector. This also supports the view that both public and private investment are necessary to provide the infrastructure and credit facilities that can alleviate the capital scarcity constraints faced by farmers, ultimately boosting productivity and output (Rahji and Fakayode, 2009).

Lastly, the results show that commercial banks' loan to the manufacturing sector (BLM) has a significant positive influence on the extent to which the agricultural sector performs in Nigeria. The financial sector can, through its institutions such as the "Bank of Agriculture," mobilize agricultural loans to investors in the agricultural sector who need them for investment (Ademu, Dabwor & Ezie, 2019). Also, Egwu (2016) revealed that Commercial Bank Credit to the Agricultural sector (CBCA) and Agricultural Credit Guarantee Scheme Fund Loan to Nigeria's Agricultural sector (ACGSF) were significant to agricultural sector output in Nigeria.

Table 7: The Bounds Test

Critical value	Lower bound	Upper bound
10%	2.08	3
5%	2.39	3.38
1%	3.06	4.15

Source: EViews' output F-statistic calculated: As earlier outlined (see Table 3)

The ARDL bounds test results are presented in Table 7. The parameters for this test remain as previously discussed. Here, the F-statistic value, 6.1, is greater than both the lower and upper limit values, 2.39 and 3.38, at the critical level; hence, a long-run relationship is present. This calls for the estimation of the short-run dynamics.

Table 8: ARDL Error Correction Regression Estimates

Dependent Variable: DLOG(MFG)				
Regressors	**Coefficient**	**Std. Error**	**t-Statistic**	**Prob.**
ECM (-1)	-0.555645	0.070547	-7.876***	0.0000
R-squared	0.584283			
Adjusted R-squared	0.584283			
Durbin-Watson stat	2.037528			

*Source: Calculated by the Authors, *** significant at 1%, **5%, *10%*

From Table 8 above, the error correction model's (ECM) R-squared value is reported as -0.5842, which indicates that the independent variables explain around 58% of the variance in the dependent variable, meaning that the model fits the data well. The coefficient of the error correction term is -0.5556 and is statistically significant at the 5% level, suggesting that the variables converge at their long-run equilibrium after the short-run disequilibrium. The ECM demonstrates that yearly adjustments are made to account for around 55% of the variable disequilibrium. The outcome also implies that, given the rapid rate of change, the impact of financial policy on agriculture may be immediate.

3.1.4. Post Estimation Diagnostic Tests

Table 9: Autocorrelation Test and Heteroskedasticity Test

	Obs*R-squared	Prob. Chi-Square
Autocorrelation Test	27.44735	0.1201
Heteroskedasticity Test	63.95062	0.3120

Source: Author compilation from EViews

The serial correlation and heteroskedasticity tests for the second model are shown in Table 9. Following the aforementioned hypotheses (see Section 3.1.4), we observe that the second ARDL model is free of autocorrelation and heteroscedasticity. The observed*R-squared probability values of 12% and 31%, respectively, are greater than the 5% level of significance. To put it simply, the model's estimates are reliable for forecasting and economic research.

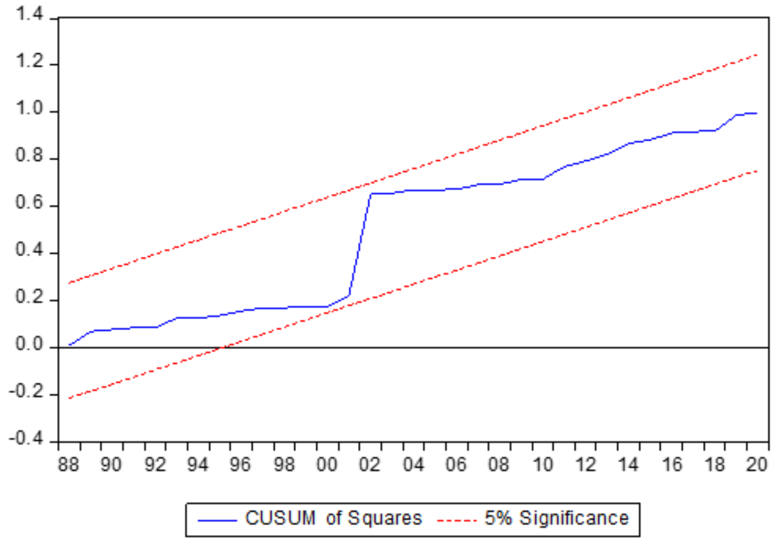

Figure 3: CUSUM Test of Model Stability

Similar to the previous test shown in Figure 3, the CUSUM of Squares test for model 2 also indicates stability. The CUSUM of Squares line remains within the 5% boundary, which leads us to conclude that the estimated coefficients are stable and there is no evidence of a structural break.

3.1.5. Results of The Estimated ARDL Model For Objective 3

The results of the estimated ARDL model for objective 3 are presented in Table 10 below:

Table 10: Impact of Other Foreign Capital on Manufacturing Sector

Dependent Variable: LOG(MFG)				
Regressors	Coefficient	Std. Error	t-Statistic	Prob.*
LOG (MFG (-1))	0.630216	0.081467	7.735***	0.0000
LOG(REM)	-0.032812	0.043375	-0.756475	0.4567
LOG(ODA)	0.066774	0.037867	1.763385	0.0906
LOG (ODA (-1))	-0.061747	0.055423	-1.114102	0.2763
LOG (ODA (-2))	0.124481	0.054824	2.2705**	0.0324
TRG	-0.020752	0.010012	-2.0726**	0.0491
TRG (-1)	0.024456	0.009891	2.4724**	0.0209
TRG (-2)	0.019680	0.007421	2.6520**	0.0140
EXR	-0.000497	0.001735	-0.286381	0.7770
EXR (-1)	0.000204	0.002227	0.091609	0.9278
EXR (-2)	0.002403	0.001517	1.58432*	0.1262
LOG(CBLMF)	-0.414219	0.196666	-2.1062**	0.0458
LOG (CBLMF (-1))	-0.270042	0.226635	-1.191528	0.2451
LOG (CBLMF (-2))	0.633276	0.178134	3.555***	0.0016
CONSTANT	6.294752	1.651627	3.811***	0.0008
R-squared	0.876537	Durbin-Watson stat		2.838981
Adjusted R-squared	0.862850			
F-statistic	71.34841			
Prob(F-statistic)	0.000000			

*Source: Calculated by the author. *** significant at 1%, **5%, *10%*

The coefficient of official development assistance (ODA) is 0.124 and statistically significant at the 5% level of significance, indicating that the variable positively impacts Nigeria's manufacturing sector output. This outcome conforms with a priori expectation as it is expected that an increase in foreign assistance raises the output of the manufacturing sector through the provision of necessary infrastructure, machines, and equipment for industry. However, the flow of foreign capital has not translated into growth in the output of the manufacturing sector, as the sector's output has continued to dwindle. This is a major concern and has been blamed on inappropriate and inconsistent manufacturing sector policies, inadequate human capital, lack of capacity for strategic government intervention, and poor socioeconomic and political factors that do not encourage the full and purposeful utilization of foreign aid in Nigeria (Abdullahi,et al. 2017).

Similarly, the results show a positive and significant coefficient of Trade Globalization (TRG). While this finding is consistent with standard economic theory, it appears to be contradictory to Nigeria's over-reliance on primary commodity exports and its weak industrial base. This may be due to the fact that the country's poor industrialization policy and low investment into the real sector of the economy have seen the economy highly dependent on crude oil export and not diversifying into other sectors to produce a variety of commodities for export. The absence of sound policy has been a bane to the country's export and continuous exportation of mainly primary commodities. However, this outcome conforms with a priori expectation as it is believed that an increase in trade openness raises the performance of the manufacturing sector, as interconnectedness among economies and international trade confer those advantages, such as sharing and transfer of technology, that enhance both quality and quantity of output in the economy.

Lastly, the result of the estimated model shows that the coefficient of commercial banks' loan to manufacturing sector (CBLMF) is 0.6332 and statistically significant, suggesting that an increase in commercial bank loans to the sector will raise output by 0.633% approximately. This result is as expected, as the financial sector is perceived as the conduit of growth in every economy through which the better performance of other sectors is achieved. This confirms that, in the absence of significant FDI, domestic credit plays a critical role in supporting industrial activities. (Ademu, Dabwor & Ezie, 2019).

Table 11: The Bounds Test

Critical value	Lower bound value	Upper bound value
10%	2.08	3
5%	2.39	3.38
1%	3.06	4.15

Source: EViews' output. F-statistic calculated: As previously stated (see Table 3 for reference).

Table 11 displays the results of the ARDL bounds test for cointegration for Model 3. The F-statistic – 4.247 is greater than both the lower and upper limit values, 2.39 and 3.38, at the 5% level of significance, implying that there is a long-run association. The short-run dynamics need to be estimated.

Table 12: ARDL Error Correction Regression Estimates

Dependent Variable: DLOG(MFG)				
Regressors	**Coefficient**	**Std. Error**	**t-Statistic**	**Prob.**
ECM (-1)	-0.257952	0.043302	-5.956***	0.0000
R-squared	0.667839			
Adjusted R-squared	0.649884			
Durbin-Watson stat	1.811225			

*Source: Author, *** significant at 1%, **5%, *10%*

Table 12 displays the short-run dynamics from the projected long-run ARDL model. The R-squared of the ECM is 0.6678, indicating that the independent variables account for about 66.7% of the variation in the dependent variable, indicating that the model is a good match. According to the short-run estimation, the coefficient of the error correction term is -0.2579 and statistically significant at the 5% level of significance, showing that the variables converge at their long-run equilibrium following the short-run disequilibrium. According to the ECT, around 25% of the disequilibrium among the variables will be accounted for annually in the short run. Furthermore, the result implies that the impact of government policies may be immediate due to the fast rate of adjustment.

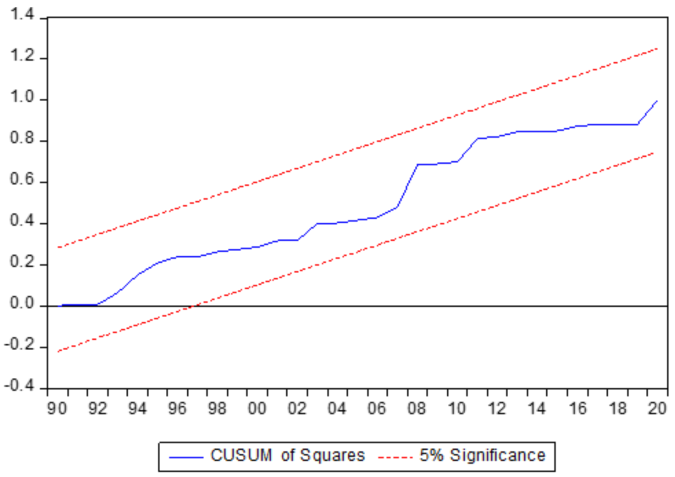

Figure 4: CUSUM Test of Model Stability

Figure 4 shows that the CUSUM of Squares' line remains within the 5% boundary line. As a result, we deduce that the estimated model's coefficients are stable.

3.1.6. Post Estimation Diagnostic Tests

Table 13: Breusch-Godfrey Serial Correlation Test

	Obs*R-squared	Prob. Chi-Square (2) and (14)
Autocorrelation Test	0.258720	0.8787
Heteroskedasticity Test	10.05326	0.7583

Source: Author

Tables 13 show the post-estimation diagnostic tests for serial/autocorrelation and heteroskedasticity for model 3. Based on the foregoing and the results in the tables above, the probability values of 87% and 99% for the observations*R-squared are greater than the 5% level of significance, respectively, and thus the null hypothesis is rejected, and the results from the estimated ARDL models are free of autocorrelation and heteroscedasticity. Simply put, the model's estimates are credible for economic analyses and predictions.

3.1.7. Results Of The Estimated ARDL Model For Objective 4

The results of the estimated ARDL model for objective 4 are presented in Table 14 below:

Table 14: Impact of Other Foreign Capital on Agricultural Sector Output

Dependent Variable: LOG(AG)				
Regressors	Coefficient	Std. Error	t-Statistic	Prob.*
LOG (AG (-1))	0.696828	0.069047	10.09***	0.0000
LOG(REM)	-0.044436	0.053644	-0.828352	0.4145
LOG (REM (-1))	0.087596	0.043112	2.0318**	0.0518
LOG(ODA)	0.020313	0.030848	0.658509	0.5156
TRG	-0.012406	0.010177	-1.219035	0.2330
EXR	-0.003697	0.001733	-2.1336**	0.0418
EXR (-1)	0.000770	0.002420	0.317946	0.7529
EXR (-2)	0.003267	0.001639	1.99365*	0.0560
LOG(CBLMF)	-0.198647	0.185328	-1.071868	0.2929
LOG (CBLMF (-1))	0.276757	0.184903	1.496770	0.1456
CONSTANT	6.173102	1.456266	4.238***	0.0002
R-squared	0.883741	Durbin-Watson stat		2.332916
Adjusted R-squared	0.877934			
F-statistic	169.4109			
Prob(F-statistic)	0.000000			

*Source: Author, *** significant at 1%, **5%, *10%*

Remittances are found to be a major factor contributing to agricultural sector output growth in Nigeria, with the results indicating that an increase in migrants' remittances brings about a 0.087% increase in agricultural sector output. This outcome is as expected, as it is believed that remittances from abroad play an important role in augmenting shortfalls in capital needed to boost output of the agricultural sector. Remittances from abroad are generally desirable because of their high multiplier effect, which occurs through an increase in household consumption expenditure on agricultural products investment.

Finally, the exchange rate (EXR) is statistically significant with a coefficient of -0.003, which suggests that the exchange rate is a major factor influencing the extent of agricultural sector performance in Nigeria. It follows that, all else being equal and on average, 1% increase in the exchange rate reduces agricultural sector performance by 0.003% approximately. This result is as expected, as a devalued domestic currency makes the importation of modern farm implements and machinery more expensive, thereby hindering productivity growth. Furthermore, it makes Nigeria's agricultural exports more expensive for foreign buyers, reducing their competitiveness in the global market. As Wasiu et al. (2021) noted, the agricultural sector is heavily affected by exchange rate fluctuations, which impact both the cost of inputs and the price of exports.

Table 15: The Bounds test for long-run relationship/cointegration

Critical value	Lower bound value	Upper bound value
10%	2.08	3
5%	2.39	3.38
1%	3.06	4.15

Source: EViews' output

From Table 15 above, the F-statistic value of 4.66 exceeds both the lower and upper bounds at the 5% level of significance; therefore, a long-run relationship exists. The next step is to assess the short-run dynamics.

Table 16: ARDL Error Correction Regression Estimates

Dependent Variable: DLOG(AG)				
Regressors	Coefficient	Std. Error	t-Statistic	Prob.
ECM (-1)	-0.303172	0.048164	-6.294***	0.0000
R-squared	0.577157			
Adjusted R-squared	0.527410			
Durbin-Watson stat	2.332916			

*Source: Author, *** significant at 1%, **5%, *10%*

Table 16 displays the short-run dynamics from the estimated long-run ARDL model. The R-squared of the error correction model (ECM) is 0.5771, indicating that the independent variables account for approximately 57% of the variation in the dependent variable, indicating that the model is a good fit. According to the short-run estimation, the coefficient of the error correction term (ECT) is -0.3031 and statistically significant at the 5% level of significance, showing that the variables converge at their long-run equilibrium following the short-run disequilibrium. According to the ECT, around 30% of the disequilibrium among the variables is accounted for annually in the short run. Furthermore, the outcome implies that the impact of policy may be immediate.

3.1.8. Post Estimation Diagnostic Tests

Table 17: Post Estimation Diagnostic Tests

	Obs*R-squared	Prob. Chi-Square (2) and (10)
Serial Correlation Test	3.192582	0.2026
Heteroskedasticity Test	2.953994	0.9825

Source: Author

Tables 17 show the serial correlation and heteroskedasticity results for model 4. Based on the results in the tables above, the probability values of 20% and 97% for the observations*R-squared are greater than the 5% level of significance, respectively, and thus the null hypothesis of autocorrelation is rejected. This implies that the model's predictions are trustworthy for economic predictions.

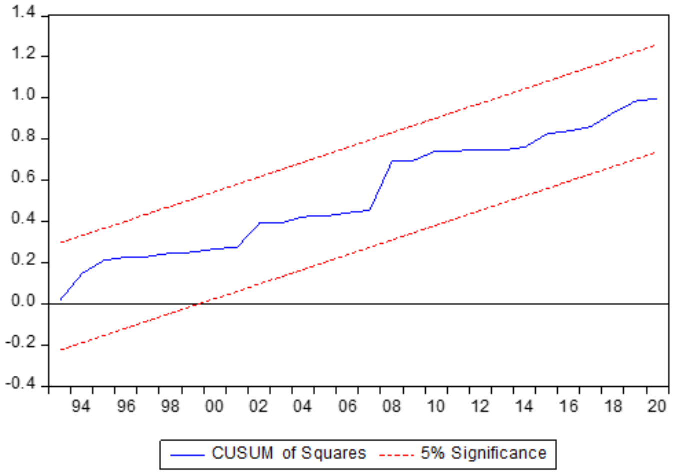

Figure 5: CUSUM Test

Figure 5 depicts the CUSUM of Squares' line, which is within the 5% boundary line. As a result, we deduce that the estimated model's coefficients are consistent.

4. Discussions

The most significant contribution of this study lies in its demonstration that foreign capital flows exert contrasting effects on Nigeria's two critical economic sectors. While the empirical results indicate that FDI has no statistically significant impact on manufacturing output, the agricultural sector benefits from a strong and transformative influence.

The absence of a significant relationship between FDI and manufacturing output can be attributed to several interrelated factors. Historically, FDI inflows into Nigeria have been disproportionately concentrated in extractive industries such as oil and gas, with only a negligible share directed toward the manufacturing sector (Adeagbo & Jimoh, 2023). Even in cases where manufacturing does attract investment, systemic challenges, including chronic infrastructural deficits, unreliable power supply, high operational costs, and an unfavorable business environment, limit the sector's ability to absorb and benefit from foreign capital. These constraints reduce the likelihood that the positive spillovers typically associated with FDI, such as technology transfer, skill development, and competitiveness gains, will materialize in the Nigerian manufacturing context. Consequently, while domestic factors such as capital formation and commercial bank lending emerge as significant drivers of manufacturing output, FDI does not appear to play a meaningful role. This finding diverges from studies that reported positive effects of FDI on Nigerian manufacturing (Sani et al., 2021; Yaya et al., 2022), but aligns with research highlighting its negligible impact (Adeagbo & Jimoh, 2023).

In contrast, the agricultural sector demonstrates a markedly different response to FDI. The positive and significant impact observed suggests that agriculture is highly responsive to capital injections, particularly given its persistent capital scarcity and limited access to modern technology. In this sector, FDI frequently supports large-scale, commercial farming ventures, which are better positioned to navigate Nigeria's difficult business environment while exploiting the country's vast, underutilized arable land. These results corroborate earlier findings by Ananwude et al. (2025) and Kastratović (2023), who documented FDI's potential to enhance agricultural productivity and exports in developing economies. However, the evidence also contrasts with studies such as Ognaje and Salami (2022), who reported a negative long-run impact of FDI on Nigeria's agricultural GDP. The divergence suggests that the effectiveness of FDI depends on the type, scale, and orientation of investment projects, with large-scale commercial initiatives proving more beneficial than fragmented or poorly integrated inflows.

By adopting a comparative approach, this study helps clarify the mixed and often contradictory evidence in the literature. Previous research has typically examined agriculture and manufacturing in isolation, producing fragmented insights that left the broader picture unclear. In contrast, this study simultaneously investigates both sectors within a unified framework, thereby revealing that the heterogeneous effects of FDI are rooted in sectoral structures and absorptive capacities. This comparative perspective not only fills an important gap in the Nigerian context but also provides a methodological contribution to the wider debate on foreign capital flows in developing economies.

Taken together, the findings demonstrate that FDI cannot be regarded as a universal "panacea" for economic development. Its effectiveness depends not only on sector-specific characteristics but also on the nature of investment and the broader policy environment. For manufacturing, comprehensive structural reforms, ranging from infrastructure development and financial sector efficiency to improvements in governance and regulatory stability, are essential before the sector can fully capitalize on FDI spillovers. By contrast, the agricultural sector already exhibits the capacity to translate foreign capital into tangible productivity gains, underscoring its potential as a critical driver of Nigeria's broader economic transformation.

5. Conclusion

Empirical studies examining the impact of FDI on the performance of Nigeria's manufacturing and agricultural sectors remain relatively limited. This study contributes to filling that gap by providing comparative evidence on the sectoral effects of FDI and other foreign capital inflows. The results show that FDI does not exert a significant impact on Nigeria's manufacturing sector, whereas it has a positive and significant influence on the agricultural sector. In addition, the findings reveal that other forms of foreign capital play important roles: official development assistance (ODA) significantly supports manufacturing, while remittances contribute positively to agricultural output.

These findings underscore the importance of recognizing sectoral heterogeneity when evaluating the developmental role of capital flows. The effectiveness of FDI and other inflows is not uniform but highly contingent on the structural and policy environments within which they operate. Thus, this study makes an important contribution by highlighting that sector-specific conditions largely determine whether foreign capital translates into tangible economic benefits.

A critical area for future research is the incorporation of institutional quality as a moderating variable in analyzing the relationship between capital flows and sectoral performance. Given Nigeria's governance challenges, such an extension could offer deeper insights into the specific reforms required to enhance the effectiveness of both foreign and domestic investment.

From a theoretical standpoint, the study extends Jorgenson's investment theory by demonstrating that external capital flows, such as FDI, ODA, and remittances, affect sectoral performance in heterogeneous ways depending on absorptive capacity and structural constraints. It also contributes to the broader FDI spillover literature by showing that positive effects are not automatic but conditioned by sectoral characteristics and institutional environments..

6. Policy recommendations

The findings carry significant implications for policymakers seeking to revitalize Nigeria's real sectors. First, since FDI was found to have no meaningful impact on manufacturing, government policy should not merely focus on attracting additional inflows. Instead, priority must be placed on creating a stable, transparent, and predictable business environment. This requires addressing structural bottlenecks, particularly through reforms in the energy sector to ensure a reliable power supply, enhancing security, and streamlining bureaucratic processes that currently discourage foreign investors. In addition, a transparent framework should be established to ensure that ODA is efficiently utilized, for example, by channeling funds into industrial parks, targeted technology transfer programs, and human capital development initiatives rather than allowing them to be diluted into general expenditure.

Second, the strong positive effects of FDI and remittances on agriculture call for targeted policies to harness these flows more effectively. To attract sustained agricultural FDI, the government should prioritize clear and secure legal frameworks for land ownership and acquisition, thereby building investor confidence in large-scale commercial farming. At the same time, Nigeria's financial sector should design innovative products, such as diaspora investment bonds or agricultural investment funds, that enable Nigerians abroad to channel remittances into productive agricultural ventures, moving this capital away from consumption toward long-term investment.

Finally, Nigeria can benefit from learning from the experiences of more industrialized economies. Instead of relying on generic development strategies, policymakers should adapt specific best practices, such as South Africa's targeted tax incentives for manufacturers and its export-promotion schemes, both of which have enhanced competitiveness. Drawing on such practical lessons could help Nigeria to reinvigorate its manufacturing base, diversify its economy, and reduce dependence on primary commodity exports.

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