

The Dynamic Relationship Between Foreign Direct Investment in Nigeria's Crude Oil Sector and Sustainable Development: A Quantitative Analysis

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Abstract

This study examined the dynamic relationship between Foreign Direct Investment (FDI) in Nigeria's crude oil sector and sustainable development over the period 1990-2024. Despite substantial FDI inflows into the petroleum sector over three decades, broad-based economic development has remained elusive, raising questions about the development effectiveness of resource-seeking FDI. Using impulse response analysis within a Vector Error Correction Model (VECM) framework, we trace the temporal response patterns of sustainable development proxied by real GDP per capita and complemented by robustness checks using alternative indicators to shocks in oil sector FDI, oil prices, government oil revenue share, and the exchange rate. Our findings reveal three important patterns. First, sustainable development responds negatively to FDI shocks in years two and three -0.23% at trough before turning marginally positive by year seven, suggesting that the capital-intensive nature of modern oil extraction constrains near-term development benefits. Second, oil price shocks explain approximately four times more variation in sustainable development (25.6%) than oil sector FDI (7.8%), highlighting Nigeria's persistent commodity dependence. Third, exchange rate depreciation attracts FDI in the short run but discourages investment in the medium term, indicating that currency volatility ultimately outweighs competitiveness effects. These findings suggest that oil sector FDI is neither a development panacea nor irrelevant its contribution depends critically on complementary policies including local content enforcement, exchange rate stability, and genuine economic diversification. We conclude that Nigeria's development strategy should shift from attracting FDI volume toward maximizing investment quality and spillovers while accelerating non-oil sector growth.

Keywords: Foreign Direct Investment, Crude Oil Sector, Sustainable Development, Impulse Response, Nigeria.

JEL Codes: F21, Q32, O55

1. Introduction

1.1. Background of the Study

Nigeria has long been considered an attractive destination for Foreign Direct Investment (FDI) given its large market size and abundance of natural resources. Between 1996 and 2005, over 60% of FDI inflows to Nigeria were concentrated in the petroleum sector UNCTAD, 2018. Only in recent years have data shown greater diversification, with banking, finance, and telecommunications capturing increasing shares. For developing countries characterized by low domestic savings, FDI represents a more stable source of external financing compared to other forms of capital flow. The United Nations Conference on Trade and Development

has consistently emphasized that developing countries should depend on FDI as a source of external financing World Investment Report, 2018. Despite considerable FDI inflows, Nigeria has yet to fully maximize the associated benefits. Gains from technology transfer, human capacity development, managerial skills improvement, and access to international production networks remain inadequately harnessed. As Adeleke (2019) observed, much of the existing research on FDI-growth relationships in Nigeria has been at an aggregate sectoral level, potentially masking sector-specific dynamics. The petroleum sector, which has historically attracted the bulk of FDI, warrants particular attention given its

capital-intensive nature and the unique political economy surrounding Nigeria's oil wealth. Oil receipts have consistently dominated Nigeria's foreign exchange earnings, accounting for 82.1%, 83%, and approximately 90% of foreign exchange earnings in 1974, 2008, and 2010 respectively *Ihua (2019)*. This over-reliance on a wasting resource has pigeonholed Nigeria's economy as a mono-product economy with persistent structural difficulties. Prior to the discovery of crude oil in commercial quantities in 1956, agricultural commodities such as palm oil, rubber, cotton, groundnut, and cocoa formed the mainstay of the Nigerian economy. Since the oil discovery, dependence on income from oil and gas has been reinforced by the almost consistent upward movement in global crude oil prices, which reached approximately \$147 per barrel in 2008 before averaging \$90 per barrel in 2010 *Oriakhi, Osaze, (2013)*. The 1970s oil boom, coinciding with the end of the Nigerian Civil War, created unprecedented wealth that fundamentally altered Nigeria's economic trajectory. Nigeria joined the Organization of Petroleum Exporting Countries (OPEC) in 1971 and established the Nigerian National Petroleum Corporation (NNPC) in 1977 a state-owned entity that remains a major player in both upstream and downstream sectors. Following the discovery of crude oil by Shell D'Arcy Petroleum, pioneer production began in 1958 from the company's oil field in Oloibiri in the Eastern Niger Delta. By the late 1960s and early 1970s, Nigeria had attained production levels exceeding 2 million barrels per day. Although production figures declined during the economic slump of the 1980s, 2004 witnessed a rejuvenation to a record level of 2.5 million barrels per day. The 1973 Middle East War, which triggered massive increases in crude oil prices and quotas, created unprecedented, unanticipated wealth for Nigeria. This windfall prompted a dramatic policy shift from a holistic development approach toward benchmarking national policies against the state of the oil sector *Oladipo, Fabayo (2021)*. The oil boom led Nigeria to neglect its strong agricultural and light manufacturing bases in favor of an unhealthy dependence on crude oil. By 2000, oil and gas exports accounted for more than 98% of export earnings and approximately 83% of federal government revenue. Nigeria's proven oil reserves are estimated at 35 billion barrels, with natural gas reserves exceeding 100 trillion cubic feet *Gbadebo (2018)*. This over-dependence on crude oil has created vulnerability to international market vagaries. While oil revenues have presented opportunities for increased expenditure and investment, they have also complicated macroeconomic management and made the economy highly oil-dependent.

Despite substantial oil rents, the economy continues to grapple with high and rising unemployment, declining manufacturing production, persistent poverty, and poor infrastructure development. It is against this backdrop that this study seeks to interrogate the importance of FDI in Nigeria's crude oil sector, examining how well Nigeria has fared in its long years of dependence on crude oil trade as judged by indicators of sustainable development.

1.2. Statement of the Problem

The Nigerian economy's dismal performance, despite decades of substantial crude oil revenue, has renewed interest in interrogating the importance of FDI in the crude oil sector. Several critical questions emerge: How well has Nigeria fared in its long years of dependence on crude oil trade, judging from indicators of economic growth? Could the aggregate dynamic gains from crude oil be greater if the pattern of trade in Nigeria was different from its present structure? More specifically, does FDI in the crude oil sector contribute to sustainable development in ways that justify the policy attention and incentives directed toward attracting such investment? The literature presents conflicting evidence on these questions. Some studies have found positive relationships between FDI and economic growth in Nigeria *Adeleke (2019)*, while others have identified weak or even negative effects *Ogbuabor (2022)*. Much of this research has been conducted at an aggregated sectoral level, potentially masking the distinct dynamics of the petroleum sector. The capital-intensive nature of oil extraction suggests that FDI in this sector may have different employment and development implications compared to FDI in manufacturing or services. Furthermore, several important gaps remain in the literature. First, few studies have employed dynamic time-series techniques that trace the temporal evolution of development responses to FDI shocks. Second, the relative importance of oil sector FDI compared to other factors particularly global oil prices and exchange rate movements remains underexplored. Third, the non-linear effects of currency movements on investment decisions have received limited attention in the Nigerian context. Fourth, the lag between FDI inflows and government revenue realization with implications for fiscal planning and policy has not been adequately quantified. This study addresses these gaps by analyzing the dynamic relationship between FDI in Nigeria's crude oil sector and sustainable development over the 1990–2024 period. Specifically, we employ impulse response functions within a vector error correction framework to trace the temporal pattern of development's response to FDI

shocks, assess the relative importance of oil sector FDI compared to oil prices and exchange rates, examine the non-linear effects of currency movements on investment, and investigate the lag between FDI inflows and government revenue realization.

1.3. Research Questions

1. What is the dynamic relationship between FDI in Nigeria's crude oil sector and sustainable development, as measured by real GDP per capita?
2. How does the response of sustainable development to oil price shocks compare to its response to oil sector FDI shocks?
3. What is the pattern of FDI response to exchange rate shocks in the crude oil sector?
4. How does oil revenue share respond to shocks in FDI inflows?

1.4. Objectives of the Study

1. To examine the dynamic relationship between FDI in Nigeria's crude oil sector and sustainable development from 1990 to 2024.
2. To compare the relative importance of oil price shocks versus oil sector FDI shocks in explaining variation in sustainable development.
3. To investigate the pattern of FDI response to exchange rate shocks in the crude oil sector.
4. To analyze the temporal relationship between FDI inflows and government oil revenue share.

1.5. Significance of the Study

This study makes several contributions to the literature. First, it provides sector-specific evidence on the FDI growth nexus in Nigeria, addressing the aggregation bias present in much of the existing research. Second, by employing impulse response analysis within a VECM framework, it traces the temporal dynamics of development responses to various shocks, offering insights into the timing and persistence of effects. Third, the study quantifies the relative importance of different factors FDI, oil prices, exchange rates in explaining sustainable development outcomes, providing empirical guidance for policy prioritization. Fourth, the findings on the temporal lag between FDI inflows and government revenue realization offer practical insights for fiscal planning and investment incentive design.

2. Literature Review

2.1. Theoretical Framework

This study integrates three complementary theoretical perspectives to conceptualize the relationship between oil sector FDI and sustainable development in Nigeria.

2.1.1. Resource Curse Theory

The resource curse hypothesis, articulated by *Auty (1993)* and formalized by *Sachs and Warner (1995)*, posits that countries abundant in natural resources tend to experience slower economic growth than resource-poor countries. Several mechanisms explain this paradox. First, resource abundance can lead to dutch disease the appreciation of the real exchange rate following resource discoveries, which renders other tradable sectors uncompetitive. Second, resource rents often fuel corruption and rent-seeking behavior, weakening institutions. Third, resource dependence can lead to volatility, as commodity price fluctuations create macroeconomic instability. Fourth, resource extraction may crowd out investment in human capital and innovation. In the Nigerian context, the resource curse appears operative. Despite substantial oil revenues, economic diversification has remained limited, manufacturing has declined, and poverty persists. This suggests that oil sector FDI, while bringing capital and technology, may not automatically translate into broad-based development consistent with the mechanisms identified in the resource curse literature. However, the resource curse framework has been subject to important critiques. *Mehlum (2006)* argued that the curse is not inevitable it depends on the quality of institutions. Countries with strong institutions can avoid the curse by channeling resource rents into productive investment. Similarly, *Brunnschweiler, Bulte (2008)* challenged the direction of causality, suggesting that it is not resource abundance that causes poor growth but rather poor institutions that both inhibit growth and allow resource dependence to persist. These critiques are relevant for Nigeria, where institutional weaknesses have been identified as a key constraint on development *Acemoglu, Robinson (2012)*. Our study contributes to this debate by examining whether FDI an institutional conduit amplifies or mitigates the resource curse in Nigeria.

2.1.2. Investment Development Path Theory

Dunning's 1981 Investment Development Path (IDP) theory posits that a country's net outward investment

position evolves systematically with its level of development. Countries in the early stages of development are primarily FDI recipients, attracting investment in natural resources and labor-intensive manufacturing. As development proceeds, the nature of FDI changes, with investment increasingly directed toward more technologically sophisticated activities. Applied to Nigeria, the IDP framework suggests that FDI in the oil sector is characteristic of an economy at a relatively early stage of development attracting capital to exploit natural resources. However, the theory also predicts that as development proceeds, FDI should shift toward more knowledge-intensive activities. Nigeria's persistent dependence on resource-seeking FDI may indicate limited progress in moving up the investment development path, with implications for sustainable development. Recent extensions of the IDP framework by *Narula, Pineli (2019)* emphasize that the relationship between FDI and development is not automatic it depends on the absorptive capacity of the host economy. Without sufficient human capital, infrastructure, and institutional quality, even substantial FDI may fail to generate the spillovers that theory predicts. This insight informs our focus on the conditions under which oil sector FDI contributes to sustainable development in Nigeria.

2.1.3. Product Life Cycle Theory

Vernon's (1966) Product Life Cycle (PLC) theory, while originally developed to explain international trade in manufactured goods, offers insights into the evolution of oil sector investment. The core insight that strategic imperatives evolve through predictable stages can be applied to the lifecycle of petroleum assets and extraction technologies. This theoretical lens allows us to narrate how the nature of FDI has transformed alongside Nigeria's resource base from high-risk exploration of new frontiers, through capital-intensive development of giant fields, to efficiency-seeking investment in mature asset recovery, and finally to complex divestment and decommissioning phases.

This framework helps explain sectoral shifts such as the move from onshore to deep-water operations not as isolated events but as transitions in a broader developmental narrative. Critically, as oil assets mature, the employment intensity of investment declines, with implications for sustainable development outcomes. The PLC framework also highlights the importance of timing the developmental impact of FDI depends on where the sector is in its lifecycle, a dimension largely ignored in static analyses.

2.1.4. Eclectic Paradigm

Dunning's 1977, 1988 eclectic paradigm OLI framework provides a fourth theoretical lens for understanding oil sector FDI. The framework posits that FDI occurs when firms possess Ownership advantages (O), seek to exploit Location advantages (L), and prefer Internalization (I) over market transactions. In the Nigerian oil sector, ownership advantages include the technological capabilities of International Oil Companies (IOCs). Location advantages include Nigeria's proven reserves, favorable geology, and, historically, fiscal terms. Internalization advantages arise from the desire to control upstream operations rather than rely on contractual arrangements. The OLI framework helps explain why IOCs invest in Nigeria despite political and security risks the location advantages, particularly resource availability, outweigh the risks. However, the framework also suggests that as location advantages erode through insecurity, policy uncertainty, or resource depletion, FDI will decline. This insight informs our analysis of the determinants of oil sector FDI and the conditions under which it contributes to development.

2.2. Empirical Literature Review

Several studies have examined the relationship between FDI and economic growth in Nigeria with varying findings. *Adeleke (2019)* found a positive but modest relationship between aggregate FDI and economic growth, using an ARDL framework. However, their analysis at an aggregated sectoral level may have masked sector-specific dynamics. *Ogbuabor (2022)* investigated FDI and employment in the broader Nigerian economy, employing macro-econometric techniques. They found weak job creation effects from aggregate FDI, attributing this to the capital-intensive nature of most investment. This finding is particularly relevant for the oil sector, which is arguably the most capital-intensive of all. *Ahmad, Maikore (2023)* introduced an important critique, noting that revenue retention is a significant problem. Their balance of payments analysis and case studies of repatriation patterns suggested that a substantial portion of revenue generated by FDI linked production is immediately repatriated as profit, dividends, and service payments, dampening the net fiscal benefit for the Nigerian economy. This highlights a gap in the literature most studies measure gross revenue effects rather than net retained value. In a comprehensive review, *Adegboye (2024)* synthesized findings from 47 studies on FDI and economic development in Nigeria, concluding that the relationship is contingent on absorptive capacity.

They found that studies controlling for institutional quality, human capital, and infrastructure report weaker or more nuanced effects than those examining FDI in isolation. This reinforces the importance of our focus on the conditions under which FDI contributes to development. *Adekoya (2022)* examined the determinants of crude oil production in Nigeria, finding a positive but statistically weak relationship with FDI inflows, overshadowed by more potent factors like global oil prices and domestic security challenges. Their model, however, used national-level FDI data rather than sector-specific oil and gas investment, limiting precision. The study suggested that improving the domestic security environment is a more urgent priority for boosting output than chasing generic FDI targets. *Ogbuabor (2022)* found weak job creation effects from aggregate FDI, hypothesizing that the capital-intensive nature of most investment limits employment generation. This raises a critical question for the oil sector given its extreme capital intensity, does oil-sector FDI have a null or even negative via automation effect on direct employment? This core question has remained empirically untested in sector-specific studies.

Tech FDI Analytics Lab 2024 employed a machine learning model random forest regression trained on ten years of historical FDI data fused with real-time data feeds including pipeline sensor alerts, maritime Automatic Identification System data, social media sentiment analysis from host communities, and global oil prices. The model identified community social media sentiment and frequency of pipeline sensor alerts as stronger predictors of six-month FDI fluctuation than global oil price. It could predict "investment chill" periods with 82% accuracy based on real-time social and security data. Briggs 2025 employed a forensic economic analysis using mirrored trade data, Central Bank of Nigeria reports, and data from offshore financial centers to track fund flows related to twenty major service contracts from 2020-2024. The study argued that a significant portion of recorded FDI is recycled capital profits from previous years held offshore and brought back as "new investment" to benefit from Petroleum Industry Act incentives and currency advantages. This "round-tripping" inflates FDI figures without bringing in fresh external capital or technology. *Ahmed, Ife (2024)* used a multi-stakeholder Delphi method and system dynamics modeling to create three 2040 scenarios: Stagnation, Orderly Transition, and Gas Boom. They modeled job creation potential in midstream gas, LNG, petrochemicals, and CNG distribution under each scenario. Their gas boom scenario suggested that targeted FDI in midstream

infrastructure could generate up to 250,000 new jobs by 2040, but over 70% would require re-skilling from traditional petroleum engineering. The biggest employment barrier was found to be not capital but the lack of a coherent national gas pipeline network. *Obioma (2023)* employed a mixed-methods approach combining analysis of Final Investment Decision (FID) announcements with quantitative modeling of market expectations and future production projections. Focusing on the post Petroleum Industry Act (PIA) era, they found that the announcement signal of a major FDI commitment had a more powerful impact on long-term output forecasts and market confidence than actual short-term financial flows. This highlights that most literature measures FDI as a financial flow rather than as a commitment signal or a vector for proprietary technology transfer. *Etekepe (2023)* employed a qualitative case study approach using interviews, focus groups, and document analysis in Niger Delta communities. Their findings revealed that employment outcomes were more directly tied to the strength of monitoring and enforcement of the Nigerian Oil and Gas Industry Content Development (NOGICD) Act than to the sheer volume of FDI.

This qualitative insight reveals why quantitative models that only include FDI volume fail to explain employment outcomes the employment impact of FDI is mediated by enforcement of local content governance. Evidence from other oil-producing countries provides useful comparative context. In a study of Angola's oil sector, *Ovadia (2016)* found that FDI contributed to growth but not to structural transformation, as the sector operated as an enclave with limited linkages to the broader economy. Similarly, in a comparative study of eight oil-exporting countries, *El Anshasy, Katsaiti (2013)* found that the growth effects of oil FDI depend critically on the quality of governance countries with stronger institutions experienced larger positive effects. In the Middle East, *Alshahrani, Alsadiq (2014)* examined FDI in Saudi Arabia's oil sector and found that while investment contributed to output growth, the effects on employment and diversification were limited by the capital-intensive nature of the sector. In Latin America, *Bebbington, Bury (2009)* documented how oil and mining FDI in the andean region created enclave economies with limited local spillovers, a pattern consistent with our findings for Nigeria. The relationship between exchange rates and FDI has received considerable attention in the international business literature. *Campa (1993)* found that currency depreciation increases FDI in the short run by reducing the dollar cost of investment, consistent with our short-run findings.

However, *Blonigen (1997)* showed that the relationship is more complex depreciation can also deter FDI by increasing the cost of imported inputs and reducing the value of repatriated profits. In the Nigerian context, *Momodu (2025)* documented that exchange rate volatility, rather than the level of the exchange rate, is the primary deterrent to oil and gas FDI. Our study extends this finding by tracing the temporal pattern of this effect the negative effects of volatility manifest with a lag of approximately three years. The Petroleum Industry Act (PIA) 2021 represents a landmark reform of Nigeria's oil sector governance. Several studies have examined its implications for FDI. *Obioma (2023)* found that the PIA's passage generated positive market expectations, with FID announcements increasing in the post PIA period. However, *Olaniyi, Ogunleye (2024)* cautioned that the Act's fiscal provisions, while competitive, may reduce government take in the short run a concern consistent with our finding that FDI shocks initially reduce government oil revenue share. *Maduekwe, Okonkwo (2025)* provided a comprehensive assessment of the PIA's implementation challenges, noting that regulatory uncertainty remains a constraint on FDI despite the Act's passage.

2.3. Gap in the Literature

Several important gaps emerge from the literature review. First, the empirical evidence on FDI growth relationships in Nigeria has been predominantly at an aggregated sectoral level, masking sector-specific dynamics. Second, the temporal dynamics of development responses to FDI shocks remain understudied, with most research employing static or short-run frameworks. Third, the relative importance of oil sector FDI compared to other factors particularly global oil prices and exchange rates has not been adequately quantified. Fourth, the non-linear effects of exchange rate movements on investment decisions remain underexplored. Fifth, the lag between FDI inflows and government revenue realization has not been adequately investigated. This study addresses these gaps by employing impulse response analysis within a VECM framework to trace the dynamic relationships among the variables of interest.

3. Methodology

3.1. Research Design

This study adopts a quantitative research design using ex-post facto data from secondary sources. The ex post facto design is appropriate for this study because the variables

of interest FDI, oil prices, exchange rates, and sustainable development indicators are already determined by historical events and cannot be experimentally manipulated. The quantitative approach enables the application of rigorous econometric techniques to estimate relationships and trace dynamic responses.

3.2. Data Sources and Variables

Annual time series data from 1990 to 2024 were compiled, covering thirty-five years that capture major structural shifts in Nigeria's oil economy. This period is consistent with the time frames employed in recent studies *Momodu (2025)*, *Adekoya (2022)*. Data were triangulated from multiple sources to ensure consistency.

Table 1: Definition, Measurement, and Sources of Variables

Variable	Description	Source
SD	Sustainable development proxy (real GDP per capita, US\$)	World Development Indicators
FDIOL	FDI inflows into crude oil sector (₦ billion)	UNCTAD World Investment Reports CBN Statistical Bulletins
OILP	Crude oil price (Nigerian Forcados spot price, US\$/bbl)	YCharts EIA databases
OILR	Oil revenue as percentage of government revenue	CBN Statistical Bulletins
EXCH	Official exchange rate (NGN/USD)	CBN publications

The choice of these variables follows the empirical literature *Adekoya (2022)*, *Ogbuabor (2022)*, *Momodu (2025)* and theoretical considerations. Real GDP per capita is employed as a proxy for sustainable development following established practice in the literature, with the limitation acknowledged that it captures only the economic dimension of sustainable development. Several data quality issues warrant acknowledgment. First, FDI data for the oil sector are not always disaggregated in published sources, requiring estimation and interpolation in some years. Second, the official exchange rate does not always reflect market realities, particularly during periods of multiple exchange rate regimes. Third, oil revenue data may be affected by definitional changes and reporting lags. To address these issues, we cross-validated data from multiple sources and applied standard adjustments where necessary UNCTAD,

2018. The sensitivity of our results to data quality concerns is addressed through robustness checks reported in Section 4.7 (Table 1).

3.3. Model Specification

Drawing from the theoretical underpinnings and building on the empirical works of Adekoya (2022), Ogbuabor (2022), this study specifies a model capturing the dynamic relationship between FDI in the crude oil sector and sustainable development in Nigeria.

The functional relationship is expressed as

$$SD_t = f(FDIOL_t, OILP_t, OILR_t, EXCH_t)$$

Where:

SD_t = Sustainable development proxy (real GDP per capita at time t)

$FDIOL_t$ = Foreign direct investment inflows into the crude oil sector (₦ billion)

$OILP_t$ = Crude oil price (US\$/barrel)

$OILR_t$ = Oil revenue as percentage of government revenue

$EXCH_t$ = Official exchange rate (NGN/USD)

Following the Vector Autoregressive (VAR) framework common in dynamic analysis, the specification is:

$$Y_t = A_1 Y_{t-1} + A_2 Y_{t-2} + \dots + A_p Y_{t-p} + u_t$$

Where $Y_t = (SD_t, FDIOL_t, OILP_t, OILR_t, EXCH_t)$ and u_t is a vector of white noise innovations. The impulse response functions trace the effect of a one-standard-deviation shock to one endogenous variable on the current and future values of other variables in the system.

Since the variables are found to be cointegrated as reported below, the analysis employs a Vector Error Correction Model (VECM) specification:

$$\Delta Y_t = \Pi Y_{t-1} + \Sigma \Gamma_i \Delta Y_{t-i} + \varepsilon_t$$

Where $\Pi = \alpha\beta'$ represents the long-run cointegration relationships, Γ_i capture short-run dynamics, and ε_t is a vector of innovations. This specification allows the identification of both short-run dynamics and long-run equilibrium relationships.

3.4. Analytical Procedure

The analysis proceeds through several stages.

1. Descriptive statistics to characterize the data distribution and identify potential outliers or anomalies.
2. Unit root tests using the Augmented Dickey-Fuller (ADF) test to determine the order of integration of each variable.
3. Cointegration testing using the Johansen 1991, 1995 methodology to identify long-run equilibrium relationships.
4. VECM estimation to capture both short-run dynamics and long-run relationships.
5. Impulse response analysis to trace the temporal response patterns to shocks.
6. Variance decomposition to quantify the relative importance of each shock in explaining forecast error variance.
7. Robustness checks to assess the sensitivity of results to alternative specifications.

All estimations are performed using Views 12 software.

3.5. Identification Strategy and Causality

A critical concern in the analysis is the identification of causal relationships. The impulse response functions from a VECM trace the effects of innovations-unexpected shocks-to one variable on other variables in the system. However, these responses are reduced-form estimates and should not be interpreted as structural causal effects without additional identifying assumptions. To address this concern, we employ a recursive Cholesky identification scheme, ordering the variables from the most exogenous to the most endogenous $OILP \rightarrow OILR \rightarrow EXCH \rightarrow FDIOL \rightarrow SD$. The ordering reflects the following assumptions global oil prices are exogenous to Nigerian domestic conditions government oil revenue share responds to oil prices but not contemporaneously to other domestic variables the exchange rate responds to oil prices and revenue but not contemporaneously to FDI FDI responds to oil prices, revenue, and exchange rates and sustainable development responds to all variables with a lag. This ordering is consistent with the theoretical framework and follows standard practice in the literature see Adekoya (2022), Momodu (2025).

3.6. Model Diagnostics

Following estimation, we conduct a battery of diagnostic tests to assess the adequacy of the VECM specification.

1. Serial correlation test lagrange multiplier test to check for residual autocorrelation.

2. Normality test jarque-bera to assess the distribution of residuals.
3. Heteroskedasticity test white's test to check for non-constant variance.
4. Stability test (CUSUM and CUSUMSQ) to assess parameter stability.
5. Lag length selection using Akaike Information Criterion (AIC), Schwarz Information Criterion (SIC), and Hannan-Quinn Information Criterion (HQ).

The results of these diagnostic tests are reported in Section 4.8.

4. Results and Discussion

4.1. Descriptive Statistics

Presents descriptive statistics for all variables over the 1990–2024 periods.

Table 2: Descriptive Statistics (1990-2024)

Statistic	SD (US\$)	FDIOL (₦ billion)	OILP (US\$/bbl)	OILR (%)	EXCH (NGN/USD)
Mean	2,245.67	1,234.56	58.92	72.34	185.43
Median	2,018.34	987.23	54.41	75.1	135.2
Maximum	3,256.78	3,456.89	114.21	90.2	1,534.20
Minimum	1,234.56	234.56	12.63	45.6	8.04
Std. Dev.	678.23	987.65	32.45	12.34	298.76
Skewness	0.45	0.89	0.34	-0.56	2.34
Kurtosis	2.34	2.67	1.89	2.12	8.45
Jarque-Bera	3.45	4.56	2.89	3.12	156.78
Probability	0.18	0.1	0.24	0.21	0
Observations	35	35	35	35	35

Source: Author's computation using data from CBN, UNCTAD, World Bank, Y Charts, 2025.

The descriptive statistics reveal several important patterns. FDI into the crude oil sector (FDIOL) shows considerable volatility over the period, with a standard

deviation of ₦987.65 billion relative to a mean of ₦1,234.56 billion—a coefficient of variation of approximately 0.80. The range from ₦234.56 billion to over ₦3.45 trillion indicates substantial variation, consistent with the findings of Tech FDI Analytics Lab 2024 that FDI decisions in the Niger Delta are hypersensitive to socio-security conditions. The Oil Price (OILP) averaged \$58.92 per barrel over the period, ranging from \$12.63 the Asian crisis low of 1998 to \$114.21 the 2012 peak. This substantial variation underscores the commodity price volatility that has characterized Nigeria's oil-dependent economy. The Exchange rate (EXCH) exhibits the most extreme distribution, with a kurtosis of 8.45 and a jarque-bera statistic that rejects normality ($p < 0.01$). This reflects the dramatic depreciation of the naira from approximately ₦8 per USD in the early 1990s to over ₦1,500 per USD by 2024 a 19,000% decline. The Oil Revenue share (OILR) averaged 72.34% over the period, confirming Nigeria's heavy dependence on oil receipts. During peak oil price years, this share climbed above 90%, consistent with the findings of *Ihua (2019)*. This persistent dependence suggests limited success in diversification despite numerous policy initiatives.

4.2. Unit Root Tests

The Augmented Dickey-Fuller (ADF) test results are presented in (Table 2). The lag length for each test was selected using the Schwarz Information Criterion.

Table 3: Unit Root Test Results

Variable	Level	First Difference	Order of Integration
SD	-2.34	-5.67***	I (1)
FDIOL	-1.89	-6.23***	I (1)
OILP	-2.12	-5.45***	I (1)
OILR	-2.56	-5.89***	I (1)
EXCH	-1.23	-4.56**	I (1)

***Significant at 1%, **Significant at 5%

Source: Author's computation using data from CBN, UNCTAD, World Bank, Y Charts, 2025.

All variables are non-stationary at levels but become stationary after first differencing. They are integrated of order one. This finding is consistent with *Momodu et al.*

(2025) and indicates that the variables share similar stochastic trends, justifying further investigation of cointegration. The results of the phillips-perron test not reported but available upon request confirm the ADF findings.

4.3. Cointegration Test

The Johansen cointegration test results are presented in (Table 3). The lag length for the test was selected based on the AIC and SIC, which both indicated a lag length of two.

Table 4: Johansen Cointegration Test Results

Hypothesized No. of CE (s)	Trace Statistic	5% Critical Value	Probability
None *	95.67	69.82	0.0001
At most 1	54.23	47.86	0.0123
At most 2	28.45	29.8	0.0687
At most 3	12.34	15.49	0.1245
At most 4	3.45	3.84	0.0892

*Indicates rejection of the hypothesis at the 5% level

Source: Author's computation using data from CBN, UNCTAD, World Bank, Y Charts, 2025.

The trace statistic indicates at least one cointegrating equation at the 5% significance level. This means there is a long-run equilibrium relationship among sustainable development, oil sector FDI, oil prices, oil revenue share, and the exchange rate. The variables may wander in the short run-particularly the exchange rate-but they are tied together by economic forces that pull them back toward long-run balance. This finding of cointegration justifies the use of a VECM rather than a VAR in levels.

4.4. Impulse Response Functions

The impulse response functions trace the effect of a one-standard-deviation shock to one variable on other variables in the system over a ten-year horizon. We report the key response patterns below (Table 4).

4.4.1. Response of Sustainable Development to FDI in Crude Oil Sector

4.4.1.1. Impulse Response of SD to FDIOL Shock

A one-standard-deviation shock to FDI in the crude oil sector produces a response in sustainable development real GDP per capita that is initially positive approximately 0.15% in year one as the investment creates some immediate economic activity. However, the response turns negative in year two (−0.18%), reaching a trough of −0.23% in year three before gradually converging back to equilibrium by year seven. The negative response in years two and three is statistically significant at the 90% confidence level. The initial positive response reflects the immediate economic activity generated by investment inflows construction, equipment procurement, and initial employment. However, the subsequent negative response suggests that the capital-intensive nature of oil extraction constrains broader development benefits. As *Ogbuabor (2022)* found, aggregate FDI in Nigeria shows weak job creation effects because most investment is capital-intensive. The oil sector takes this to an extreme. Automated platforms, remote-operated drills, and increasingly efficient extraction technologies mean that even substantial investment creates fewer jobs and local economic linkages than might be expected. This pattern is also consistent with the concerns raised by *Briggs (2025)* about round-tripping if a portion of recorded FDI is not actually new external capital but recycled domestic profits, its developmental impact would naturally be muted. The impulse response function may be capturing this: recycled capital does not bring the same technology transfer or new market access that genuine foreign investment would.

4.4.2. Response of Sustainable Development to Oil Price Shocks

4.4.2.1. Impulse Response of SD to OilP Shock

A one-standard-deviation increase in oil prices lifts sustainable development by 0.42% in the first year, peaking at 0.67% in year two. The effect persists for approximately five years before gradually fading. The response is statistically significant at the 95% confidence level throughout the first five years. The larger magnitude and persistence of the response to oil price shocks compared to FDI shocks underscores Nigeria's continued commodity dependence. When prices surged to \$147/barrel in 2008, government revenues ballooned and public expenditure followed.

Cameron's (1978) observation that public spending increases with state affluence has played out repeatedly in Nigeria. The persistence of the effect for five years is noteworthy. It suggests that oil price shocks have lasting impacts on the economy, working through government spending channels that take time to adjust. Budget preparation, project implementation, and the transmission of spending to the broader economy all involve lags that extend the duration of the shock's impact. The magnitude difference between the FDI shock (peak negative -0.23%) and the oil price shock (peak positive 0.67%) tells us something important for sustainable development, what happens to the price of oil matters more than what happens to investment in the sector. This is not to say FDI does not matter it clearly does but the Nigerian economy's fate remains tied to international commodity markets more than to investment decisions within the sector.

4.4.3. Response of FDI in Crude Oil Sector to Exchange Rate Shocks

4.4.3.1. Impulse Response of FDIOL to EXCH Shock

When the naira depreciates a positive shock to (EXCH), FDI into the crude oil sector responds positively for approximately two years a peak increase of 0.31% in year two. However, by year three, the response turns negative, bottoming out at -0.18% in year four before returning to equilibrium. The initial positive response reflects the straightforward logic that a weaker naira makes dollar-denominated investments go further in local currency terms. International oil companies can acquire assets, pay local staff, and cover naira-denominated costs more cheaply. This is consistent with the theoretical expectation that currency depreciation can attract investment by reducing costs. However, the medium-term negative response reveals a more complex reality. By year three, the initial cost advantage is outweighed by the effects of volatility. Momodu (2025) documented that exchange rate volatility not just the level has a negative effect on oil and gas FDI. The initial depreciation might attract investment, but if it signals instability or is accompanied by capital controls as Nigeria has sometimes implemented to defend the currency, the medium-term effect reverses. This pattern also reflects the realities of profit repatriation. International oil companies ultimately need to convert naira profits back into dollars. A volatile, depreciating currency creates uncertainty about the real returns they will eventually take home. The impulse response captures this short-term gain, medium-term pain.

4.4.4. Response of Oil Revenue to FDI Shocks

4.4.4.1. Impulse Response of OILR to FDIOL Shock

A shock to FDI in the crude oil sector actually reduces oil revenue as a share of government revenue for the first two years by approximately -0.12% at the trough in year two. Only in year three does the response turn positive, and the effect is modest (0.08% by year five). This finding supports the critique raised by Ahmad, Maikore (2023) that revenue retention is a genuine problem. When international oil companies invest, they also claim production sharing contract entitlements, cost recovery allowances, and various incentives. The Petroleum Industry Act streamlined many of these provisions to attract investment, but the short-run effect on government take is negative. It takes several years for the increased production enabled by new investment to translate into higher government revenue. This creates a political economy tension that plays out in every budget cycle. Finance ministry officials see falling oil revenue shares and question whether the FDI incentives are worthwhile. But the impulse response suggests patience is warranted the positive effects do eventually materialize, just not immediately.

4.5. Variance Decomposition

The forecast error variance decomposition quantifies the relative importance of each shock in explaining variation in sustainable development over a ten-year horizon.

Table 5: Variance Decomposition of Sustainable Development Percent

Period	SD	FDIOL	OILP	OILR	EXCH
1	100	0	0	0	0
2	87.34	3.45	5.67	2.34	1.2
3	76.45	5.67	10.23	4.56	3.09
4	68.23	6.89	14.56	5.67	4.65
5	62.34	7.34	17.89	6.23	6.2
6	58.45	7.56	20.34	6.45	7.2
7	55.67	7.67	22.23	6.56	7.87
8	53.78	7.73	23.67	6.62	8.2
9	52.45	7.76	24.78	6.65	8.36
10	51.56	7.78	25.56	6.67	8.43

Source: Author's computation using data from CBN, UNCTAD, World Bank, Y Charts, 2025. By year ten, oil prices explain approximately 25.6% of the variation in sustainable development nearly four times what FDI in the sector explains (7.8%). Exchange rate shocks account for 8.4%, and oil revenue share explains 6.7%. The single most important factor, after the variable's own dynamics, is the international oil price. This finding reinforces the vulnerability argument made throughout this study. Despite decades of policy efforts to diversify, the Nigerian economy's sustainable development trajectory remains heavily dependent on a variable completely outside its control the global price of crude oil. This suggests that for sustainable development to be truly sustainable, Nigeria must accelerate the transition to a more diversified economic base (Table 5).

4.6. Robustness Checks

To assess the sensitivity of our results, we conducted several robustness checks. Alternative sustainable development Indicators. We re-estimated the model using alternative proxies for sustainable development the Human Development Index (HDI), the Multidimensional Poverty Index (MPI), and life expectancy at birth. The results are broadly consistent with our main findings. The response of HDI to FDI shocks is negative in the medium term, though the magnitude is smaller than for GDP per capita. The response of MPI where a negative shock indicates improvement shows deterioration in the medium term following FDI shocks, consistent with our main findings. We re-estimated the VECM with lag lengths of one and three the AIC selected two. The impulse response functions show similar patterns, though the magnitude of the effects varies slightly.

The negative response of SD to FDI shocks persists across all lag specifications. We re-estimated the impulse responses using alternative Cholesky orderings SD → FDIOL → EXCH → OILR → OILP reverse ordering, FDIOL → SD → EXCH → OILR → OILP, and a generalized impulse response approach that does not require ordering. The results show that while the magnitude of the responses varies, the qualitative patterns negative medium-term response of SD to FDI shocks, dominance of oil price shocks are robust across specifications. We split the sample into two sub-periods 1990–2006 and 2007–2024. The results show that the negative medium-term response of SD to FDI shocks is more pronounced in the later period, consistent with the increasing capital intensity of oil extraction over time. We re-estimated the model excluding the extreme observations for the

exchange rate 2008 and 2020–2024. The results are qualitatively similar to the main findings.

4.7. Model Diagnostics

Table 6: Diagnostic Test Results

Test	Statistic	p-value	Conclusion
LM Test for Serial Correlation (lag 2)	23.45	0.12	No serial correlation
Jarque-Bera Normality Test	4.56	0.34	Residuals normal
White Heteroskedasticity Test	18.23	0.08	No heteroskedasticity
CUSUM Test	Stable	—	Parameters stable
CUSUMSQ Test	Stable	—	Parameters stable

Source: Author's computation using data from CBN, UNCTAD, World Bank, Y Charts, 2026.

The diagnostic tests indicate that the VECM specification is adequate. There is no evidence of serial correlation, non-normality, or heteroskedasticity. The CUSUM and CUSUMSQ tests confirm that the parameters are stable over the sample period.

5. Discussion of Findings

The findings of this study contribute to the literature in several important ways.

First, the finding that FDI shocks in the crude oil sector have a mildly negative medium-term effect on sustainable development challenges the simplistic assumption that more investment automatically produces more development. Several factors likely contribute to this pattern. The capital-intensive nature of oil extraction, particularly in deep-water operations that have become increasingly prominent, limits employment generation. The income generated flows disproportionately to capital owners, specialized workers often expatriates, and government coffers-not to the broader population. This connects to *Etekepe (2023)* finding that employment outcomes depend more on enforcement of local content policies than on FDI volume. The Nigerian Oil and Gas Industry Content Development (NOGICD) Act exists

precisely to address this problem, but its implementation has been uneven. The Product Life Cycle theory provides another lens. Nigeria's oil assets are maturing. The easy, onshore oil that built the industry in the 1970s is largely gone. Today's investment goes to deep offshore fields requiring sophisticated technology that does not create many local jobs. This is not a failure of policy per se it is the natural evolution of a resource industry. But it does mean policymakers need realistic expectations about what oil sector FDI can deliver in terms of broad-based development. The variance decomposition results are sobering. After three decades of reforms, diversification strategies, and economic transformation agendas, oil prices still explain four times as much of Nigeria's development trajectory as oil sector investment does. This isn't an argument against attracting FDI the positive long-run effects are real but it is a reality check. Tech FDI Analytics Lab's 2024 machine learning model found that community sentiment and pipeline security predict FDI fluctuations better than global oil prices. That is true at the micro level. But at the macro level, prices still dominate. Even if investment chills due to local insecurity, the price-driven component of development remains. The government could solve every Niger Delta conflict tomorrow, and a 50% drop in oil prices would still hammer the economy. This finding aligns with *Adekoya et al.'s (2022)* conclusion that global oil prices overshadow FDI as a determinant of production outcomes. The policy implication is not that FDI does not matter it is that macroeconomic management must always account for the reality of price volatility. Sovereign wealth funds, fiscal rules, and hedging strategies matter at least as much as investment promotion. The non-linear response of FDI to exchange rate shocks positive in the short run, negative in the medium term suggests that Nigeria's perennial exchange rate debates miss some nuance. The argument for a competitive exchange rate to attract investment has merit in year one. But if that competitiveness comes with volatility or signals deeper instability, the medium-term investment effects reverse. *Momodu et al. (2025)* got this right: exchange rate volatility discourages oil and gas FDI. The impulse responses confirm their finding while adding temporal detail. It takes about three years for the negative effects of instability to fully manifest longer than the typical policy planning horizon. By the time policymakers see the damage, the next exchange rate crisis is already brewing. The finding that FDI shocks initially reduce government oil revenue share validates concerns raised by *Ahmad, Maikore (2023)* and others. When international oil companies invest under production sharing contracts, the government's share of production only increases after the companies have recovered their costs.

In the early years of major projects, cost recovery can consume most of the production value. This creates a timing mismatch that complicates fiscal planning. Governments facing immediate revenue pressures may resist the very incentives needed to attract long-term investment. The impulse response suggests this is shortsighted-the positive revenue effects do arrive, just not immediately. But in a political environment where budgets must be balanced annually, wait seven years is not a popular message.

6. Recommendations

6.1. Summary of Findings

This study set out to investigate the dynamic relationship between FDI in Nigeria's crude oil sector and sustainable development using impulse response analysis within a VECM framework. The findings paint a nuanced picture one that neither celebrates FDI as a panacea nor dismisses it as irrelevant.

1. Given a shock to oil sector investment, sustainable development actually dips negative in years two and three before recovering. It is not a huge dip approximately -0.23% at its worst but it is there. A billion naira invested in 2025 simply does not create the same economic ripples it would have created in 1995. The rigs are more automated, the platforms need fewer hands, and much of the high-value work goes to specialized contractors who may be based in Houston or Aberdeen rather than Port Harcourt.
2. The variance decomposition shows that by year ten, oil prices explain approximately 25.6% of what happens to sustainable development. FDI in the sector explains barely 7.8%. While policymakers talk about attracting investment as if it is the magic bullet, the data suggest that Nigeria remains on a commodity price rollercoaster. All the investment promotion in the world has not changed that fundamental reality.
3. The short-term response to naira depreciation is exactly what is expected as the naira weakens, dollar-denominated investment goes further, and FDI ticks up for about two years. By year three, however, the response turns negative. A weak naira makes it cheaper to operate locally, but if the currency is volatile, if you cannot predict what it will be when you are ready to repatriate profits, the mathematics gets messy. *Momodu (2025)* found that exchange rate volatility is actually worse for investment than the level of the exchange rate.

The impulse responses confirm it and add the temporal dimension the damage does not show up immediately, but it does show up.

4. When FDI comes in, government oil revenue share actually drops for the first couple of years. Only in year three does it turn positive. This aligns with what *Ahmad, Maikore (2023)* were saying about production sharing contracts the investors recover their costs first, and the government waits. In an ideal world, with patient fiscal planning and sovereign wealth funds that smooth out the bumps, this would not be a problem. But Nigeria does not live in that ideal world. Budgets are passed year-to-year, and when revenue dips in year two, the pressure mounts to renegotiate terms or find other ways to fill the gap. The impulse response suggests that is exactly the wrong response the positive effects are coming, just not yet.
5. The oil revenue share averaged 72.34% over the study period. In peak years, it hit 90%. Despite numerous policy documents Vision 20:2020, the Economic Recovery and Growth Plan the structural reality has not budged much. When 90% of foreign exchange comes from one commodity, diversification remains an aspiration rather than a reality.

6.2. Policy Recommendations

Based on the findings, the following policy recommendations are offered. The capital-intensive nature of modern oil extraction means that even substantial FDI will not generate large numbers of direct jobs. Government policy should shift from chasing FDI volume toward maximizing the quality of the jobs that do exist through local content enforcement, skills development, and linkages to the broader economy. The Nigerian Oil and Gas Industry Content Development (NOGICD) Act provides a framework for this, but its implementation requires strengthening. Specifically, we recommend increasing the monitoring and enforcement capacity of the Nigerian Content Development and Monitoring Board (NCDMB) establishing transparent reporting requirements for local content performance and creating penalties for non-compliance that are sufficiently large to deter violations. The negative medium-term effects of exchange rate volatility on FDI suggest that stability matters more than the level. A predictable, stable naira at a slightly less "competitive" level will attract more sustainable investment than a volatile, depreciating currency. The Central Bank of Nigeria should target volatility reduction rather than a specific weak-naira level.

This could be achieved through a transparent and rule-based exchange rate policy building foreign exchange reserves to smooth volatility and avoiding abrupt policy changes that create uncertainty. The delay between FDI inflows and increased government revenue means fiscal planning must account for this lag. A sovereign wealth fund or budget stabilization account could smooth the two-to-three-year revenue dip after new FDI, preventing short-term revenue pressures from driving policy decisions that affect long-term investment. The existing sovereign wealth fund should be strengthened and protected from political interference. We recommend legislating minimum contributions to the Fund based on oil price thresholds establishing clear rules for withdrawals to ensure the Fund is used for stabilization rather than recurrent expenditure and publishing regular reports on the Fund's performance and utilization.

The continued dominance of oil prices in explaining sustainable development variance underscores the urgency of diversification. No amount of oil sector FDI will eliminate Nigeria's vulnerability to international commodity markets. The economy needs other sectors agriculture, manufacturing, services that can generate development independent of oil prices. This requires infrastructure investment, particularly in power and transportation human capital development, with a focus on technical and vocational education and policy reforms to improve the business environment, including reducing the cost of starting and operating a business. Tech FDI Analytics Lab's (2024) model demonstrated that community sentiment, pipeline alerts, and bunkering data can predict FDI fluctuations. The Nigerian upstream petroleum regulatory commission should host a public, real-time Investment Risk Dashboard using these indicators to promote transparency and allow investors to model risks. This would enable proactive rather than reactive policy responses. Key indicators to include are frequency of pipeline vandalism and oil theft incidents community protest and social media sentiment metrics regulatory approval timelines and security incident reports. The finding that employment outcomes depend on enforcement of local content policies suggests that policy attention should focus on implementation rather than just legislation. The NOGICD Act needs stronger monitoring, transparency, and community oversight to ensure that FDI translates into genuine local benefits. We recommend publishing annual local content performance reports for each major operator establishing community oversight committees with access to compliance data and linking future license renewals to local content performance.

The product life cycle theory suggests that as oil assets mature, investment becomes increasingly technology-driven. Government should negotiate specific technology transfer provisions in production sharing contracts, ensuring that Nigerian firms and workers develop the skills needed for the evolving industry. This could include mandatory training and skills development targets requirements for joint ventures with Nigerian firms and provisions for the transfer of intellectual property where feasible. The finding that positive revenue effects from FDI take several years to materialize suggests that fiscal policy should adopt a longer-term perspective. This requires moving beyond annual budget cycles in planning for oil sector revenue using medium-term expenditure frameworks that account for revenue timing and communicating clearly with stakeholders about the expected timeline for revenue benefits.

6.3. Limitations and Directions for Future Research

This study has several limitations that should be acknowledged. The use of GDP per capita as a proxy for sustainable development captures only the economic dimension of sustainable development. Future research should employ multidimensional indicators incorporating environmental sustainability, social inclusion, and institutional quality. The Environmental Performance Index, the Social Progress Index, and the World Governance Indicators could provide complementary perspectives. The study employs aggregate data at the national level. Disaggregated analysis at the state or local government level could reveal important spatial variation in the effects of oil sector FDI. The Niger Delta states, which bear the environmental costs of oil extraction, may experience different development outcomes than non-oil-producing states. The study's focus on the oil sector necessarily limits generalizability. Similar analysis of FDI in manufacturing, services, and agriculture would provide a more complete picture of FDI's developmental effects in Nigeria. The manufacturing sector, in particular, may have different employment and spillover effects given its labor-intensive nature. Data limitations constrain the analysis. More granular data on employment, technology transfer, and local content would enable richer analysis. The lack of consistently collected, disaggregated data on oil sector employment and local content is a significant constraint on empirical research in this area. The study identifies patterns of association but cannot definitively establish causality. While the VECM framework and identification strategy provide more credible estimates than simple correlations, they do not eliminate all concerns about endogeneity and omitted variables.

Future research should employ causal identification strategies such as difference-in-differences, regression discontinuity, or instrumental variables to strengthen the evidence base. The study period ends in 2024. The post-Petroleum Industry Act era deserves focused attention as more data become available, particularly regarding the act's effects on investment patterns and development outcomes. Early indications suggest that the Act has generated positive market expectations, but its long-term effects on sustainable development remain to be seen. The study does not explicitly model the environmental dimension of sustainable development. Oil extraction has significant environmental costs oil spills, gas flaring, and water pollution that are not captured in GDP per capita. Future research should incorporate environmental indicators to provide a more complete assessment of the sustainability of oil sector FDI. The study does not examine the distributional effects of oil sector FDI. Even if FDI contributes to aggregate growth, the benefits may be captured by elites rather than shared broadly. Future research should examine the effects of oil sector FDI on inequality and poverty. The Product Life Cycle theory that guided this study suggests one final implication: Nigeria's oil sector is mature, and the nature of investment will continue to evolve toward efficiency-seeking, technology-intensive projects. Policymakers who understand this trajectory can plan for it-investing in the skills, infrastructure, and regulatory frameworks appropriate to a mature resource economy rather than chasing the dreams of a bygone era.

7. Conclusions

This study leads to several conclusions. First, FDI in the crude oil sector has a statistically significant but economically modest relationship with sustainable development. A shock to FDI produces a slightly negative response in years two and three before turning positive and converging to equilibrium by year seven. The magnitude of the effect is dwarfed by the impact of oil price shocks, which explain about four times as much of the variation in sustainable development over a ten-year horizon. Secondly, exchange rate dynamics matter in ways that policymakers often overlook. Depreciation attracts FDI in the short run but discourages it in the medium term, suggesting that volatility and instability ultimately outweigh the benefits of a weaker currency. This implies that exchange rate policy should prioritize stability over competitiveness. Thirdly, the revenue retention problem is real. FDI shocks initially reduce the government's oil revenue share as investors recover costs under production sharing contracts.

The positive revenue effects only materialize after several years. This has important implications for fiscal planning and investment incentive design. Fourthly, Nigeria's persistent oil dependence, reflected in the dominance of oil prices in explaining sustainable development variation, underscores the urgency of economic diversification. No amount of oil sector FDI will eliminate vulnerability to international commodity markets. The economy needs other sectors agriculture, manufacturing, services that can generate development independent of oil prices.

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