

An Analysis of the Impact of Macroeconomic Variables and Foreign Direct Investment in Nigeria: A VECM Granger Causality Framework

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Abstract: This study examines the impact of macroeconomic variables on foreign direct investment in Nigeria over the period of 1981 to 2014. The data for the research was taken from Central Bank of Nigeria (CBN). Based on empirical analysis and econometrics technique, co integration method was adopted to measure the long run relationship between macroeconomic variables (economic growth, exchange rate, inflation-consumer price index, and oil price) and foreign direct investment and the direction of causality between the variables using VECM Granger causality framework plus variance decomposition and impulse response for robust analysis. The result from Johansen's estimation revealed FDI and macroeconomic variables have at least one common stochastic trend driving the relationship between them. The results from VECM are as follows; that there is long-run unidirectional causality between FDI and real GDP, whereas, in the short run causality do not run from any direction. There is bidirectional causality between FDI and exchange rate. However; there is no causal relationship between in the short run. There is also a noticeable unidirectional causality running from inflation rate captured by consumer price index to FDI in the short run. Bidirectional causality between FDI and Oil price was reported in the long run. These results could be a guide to policy makers in analysing the FDI inflow into the Nigerian economy as thus policies should aim at improving stock improving the level of infrastructure on the continent, opening up and liberalizing trade, strengthening institutions and reducing macroeconomic instability will be beneficial for FDI flows to the continent. Finally, policies aimed at attracting FDI are necessary because higher FDI flows can cause more banking and financial development. Also, government should strengthen the political institutions and adopt democratic principles that will ensure stability within the polity. The current crisis in the Niger-Delta region has been a major obstacle to crude oil production. The restoration of peace in the region will, in turn, too more foreign investment to Nigeria. Finally, the government should invest more in infrastructure (like power, energy, transportation, telecommunication, etc.) so as to enhance the competitiveness of the environment of investment and ultimately increase FDI inflows. All of these should be complemented with the on-going war on corruption.

Keywords: FDI, Cointegration, Impulse Response, Variance Decomposition, Macroeconomic Variables

1. Introduction

1.1. Background of the Study

The growing debate in foreign direct investment is driven by the perceived opportunities that can be derived from the utilization of foreign capital injection into the economy to add to domestic savings and promote economic growth and development (Aremu [1]. Owing to the above statement, strands of literature from UNCTAD [2] opine that foreign direct investment inflow has accounted for more than forty

percent of external development finance to developing and transition economies. For this purpose, high level of FDI inflow is clearly desirable in Nigeria. Therefore, the stability and instability of the indicators of macroeconomic performance reflect the economic situation of a country, and the level of business activities and growth determines the attractiveness of the inflow of foreign direct investments into the country Agbonifob [3].

Researching further, Mankiw [4] views foreign direct

investment as a capital investment that is owned and operated by a foreign entity. Agbonifob [3] expressed the enormous benefits of foreign direct investment to the economic prospect of Nigeria in numerous ways: first, foreign direct investment can greatly enhance the industrialization and development goals of Nigeria, by helping to finance investment. It is assumed by many economists that one of the objectives of industrialization is to provide employment for the inhabitants and make goods available for consumers. Hence, if foreign direct investment is wooed into the country it will help provide employment, training, and development of talents, technical or managerial skills to the citizens. It will also bring about the development of technology. Moreover, it can also impact on the country's balance of payment by promoting export, also helping in integrating the country's economy into a global market. Foreign Direct Investment serves as an important engine for economic development which will result in the increase of the standard of living of the people, and much more.

With so much benefit, one can only wish to have these foreign direct investments troop into the country for economic enhancement. Agbonifob [3] rightly said that there was a special relationship between Nigeria and the United States up till the mid-80s. During this period many American businessmen actively cooperated with Nigerian businessmen in every business facet, from small to gigantic business investments. This was possible as a result of the steady macroeconomic performance creating a favorable atmosphere for foreign investment to function. Chingarande & Karambakuwa [5] supported the statement that a stable economy attracts more FDI thus a low inflation environment is desired in countries that promote FDI as a source of capital flow, as such inflation is one of the indicators of macroeconomic performance which determines FDI inflow.

Few studies have been carried out based on the impact of macroeconomic performance on foreign direct investment. Bajo-Rubia & Sosvilla-Rivero [6] documented that inflation is one of the factors influencing foreign direct investment. Based on their research, the steady increase of price level leads to the decrease in the value of domestic assets. Invariably, the increase in price level leads to the decrease in net investment profit, and assets values which decrease capital inflow into the country. Inflation results in the increase of investment risk, and the disturbance in information transferred through prices. Inflation hereby is a sign of instability and lack of macro policies control. Thus, inflation has an inverse relationship with the inflow of foreign direct investment.

In the long-run, changes in the demand and supply of money depend on changes in the value of goods imported and exported as well as long-term capital flows such as foreign direct investments (FDI). Thus, the exchange rate is an important determinant of international trade in consideration to export earnings generated. The exchange rate has been a contributing factor that determines foreign direct investment, it is in this jurisdiction that Hara & Razafimahefa [7] pointed out that if exchange rate

depreciates, it will definitely attract foreign direct investment since foreign firms may merge with or acquire domestic industries. But, Harvey [8] on the other hand, opined that exchange rate volatility, in the long run, has a negative effect which in comparison is far greater than the positive effects in attracting foreign direct investment, this is because greater exchange rate volatility of Dollar currency against Naira increases uncertainty over the return of a given investment in Nigeria. Potential investors will only invest in a foreign location only as long as the expected returns are high enough to cover the currency risk. Soludo [9] emphasized that it is not the profitability of investment today that attracts investors to invest, but how long the profit will remain fairly stable over time. In his opinion, whenever, the economic situation is volatile, the investors may decide to wait, in his idea, they decide to invest in project whose cycles are short. He also enumerated that while maintaining the macroeconomic stability, avoidance of over-valued exchange rates and export orientation are important for the renewal of investment.

On the assertion of Akinlo [10] the increase in economic growth has a positive relationship with FDI since economic growth leads to greater market which in turn attracts FDI. It is in this context that a clear understanding of the connection between the macroeconomic performance and foreign direct investment in Nigeria is to be examined as this study progresses. The macroeconomic performance to be considered in this study includes Economic growth, Exchange rate, Consumer price index and Oil price.

1.2. Research Hypothesis

Below are the testable hypothesis that will be empirically carried out in the course of this study.

1. $H_0: \beta = 0$ - There is no long-run significant relationship between FDI inflow and the indicators of macroeconomic variable performance (proxy Economic growth, Exchange rate, Consumer price index and Oil price).
2. $H_0: \beta = 0$ - There is no causal significant relationship between the inflow of FDI and Economic growth in Nigeria.
3. $H_0: \beta = 0$ - There is no causal significant relationship between the inflow of FDI and Exchange rate in Nigeria.
4. $H_0: \beta = 0$ - There is no causal significant relationship between the inflow of FDI and Consumer price index in Nigeria.
5. $H_0: \beta = 0$ - There is no causal and significant impact between the inflow of FDI and Oil price in Nigeria.

The remainder of the paper is structured as follows. Section 2 discusses the related literature review. Section 3 analyzes the theoretical framework and model construction used in the analysis. Section 4 discusses the empirical results. Section 5 summarizes the findings and provides policy implication and directions for future research.

2. Literature Review

Studies over the years have examined the relationships among FDI and its determinants. For example, many scholars identified the long-run and short-run relationships among FDI, exports, imports, oil prices, exchange rate, gross fixed capital formation, RGDP (Lv et al. [11]; Tsoukalas [12]; Bekhet and Al-Smadi [13]; Bekhet and Mugableh, [14]; Hsiao and Hsiao, [15]; Iamsiraroj [16]; Pradhan et al. [17]; Othman et al., [18]). These results showed evidence of significant relationships. Also, Lv et al. [11] and Tsoukalas [12] identified the a short-run relationship among FDI inflows and their determinants. The results showed that there was a significant relationship among FDI inflows and their determinants. Sun (2011) investigated the co-integration and causality relationships between FDI and economic growth in China represented by GDP for the (1985–2010) period. The result found a unidirectional causality relationship between FDI and GDP. Also, the error correction term had a stronger conversely-adjusted effect on the long-term equilibrium relationship between economic growth and FDI. In a different methodology, Iamsiraroj (2015) use a simultaneous system of equations approach of 124 cross-country data for the period 1971–2010. Results from the estimation indicate that overall effects of FDI are positively associated with growth and vice versa; whereas labor force, trade openness and economic freedom are other key determinants of FDI, which in turn stimulate income growth further.

Malik & Malik, [20] analyzed and evaluated the impact of core macroeconomic variables GDP, Inflation and Exchange Rate on FDI inflow in Pakistan. A time series data covering four decades from the year 1971 to the year 2009, as well as OLS technique, was adopted for the analysis. The results showed that all three macroeconomic variables are positively associated with the dependent variable - FDI. The results show that GDP, inflation, and exchange rate have a positive impact on FDI inflows.

A number of empirical research works confirm the strong impacts of exchange rate on FDI. Froot and Stein [21] investigated the impact of real exchange rates on FDI from industrialized countries to the United States by using annual data covering 1974–87 periods. Breaking total FDI inflows to thirteen separate industries, they found that all of the thirteen coefficients on the exchange rate present negative signs, five of which were statistically significant.

Razmi and Behname [22] made an experiment on FDI determinants and oil effects on foreign direct investment from Islamic countries using cointegration analysis as well times series data from 1981–2010. Based on their results GDP had a positive and significant effect on FDI attraction; this means that a high market size is important for investors because they can sell their outputs very easily, and since a high GDP shows a high purchasing power, increase in GDP leads to high inflow of FDI. Also, he considered four exporting oil countries Iran, Qatar, Saudi Arabia and Kuwait) to evaluate the effect of oil extraction on FDI attraction. Their result shows that oil extraction has a negative and

significant impact on FDI. This is because investors estimate that in the host countries there is a dependency between government income and oil sale. This dependency shows that with a sudden change in oil price, economic risk in these countries will increase. Economic crisis in the years 1997, 1998 and 1999 in Asian countries had a negative effect on FDI.

Ekpo [23] examined the relationship(s) between FDI and some macroeconomic variables for the period 1970–1994. The author's results showed that the political regime, real income per capita, rate of inflation, world interest rate, credit rating, and debt service explained the variance of FDI inflows to Nigeria. Obadan [24] in his study argued that market size, trade policies, and raw materials are very important determinants of FDI in Nigeria. Anyanwu [25] maintained that domestic investment, openness and indigenization policy are very important determinants of FDI in Nigeria. However, Aremu [1] opined that the host country's FDI makes credit available to investors in a form of subsidized loans, loan guarantees as well as guaranteed export credits. He noted that these credits are provided directly to foreign investors for their operations particularly to defray some inevitable costs which invariably have an immediate impact on cash flow and liquidity.

Olatunji [26] in another development argued that despite government efforts to provide incentives to many investors, many investors are still adamant to come to Nigeria. He noted that this might not be unconnected with the lingering problems that still persist on ground. For example, poor infrastructure, general insecurity, sectarian violence, the armed revolt in the Delta region and the pervasive indiscipline that is becoming the order of the day in the Nigerian economy. Apart from the issues mentioned above, one important issue that deters many investors to come to Nigeria is the issue of the stock exchange market, how developed is the market in terms of its structure, duties, methods and its personnel. On his part, Soludo [9] maintained that it is not the profitability of investment today that attracts investors to invest, but how long will the profit remain fairly stable over time. Whenever the socio-political and economic environment is highly volatile, an investor is better off exercising his option to wait. On the other hand, he might decide to invest on those projects whose cycles are very short and can be easily undone. He also asserted that while the maintenance of the macroeconomic stability, avoidance of over-valued exchange rates and export orientation are critical for the resurgence of investment they are necessary but not sufficient conditions.

Okafor [27] analyzed the impact of pull factors on capital movement in Nigeria. The empirical analysis addresses the role of key domestic macroeconomic variables on FDI in Nigeria using the OLS estimation technique. The result shows that real GDP, interest rate, and real exchange rate are key determinants of FDI in Nigeria.

Osinubi and Amaghionyeodiwe [28] conducted a study on the impact of exchange rate volatility on foreign direct investment in Nigeria for the period 1970 to 2004. Using

Ordinary Least Squares (OLS) and the error correction model ECM estimation techniques, the findings revealed a significant positive relationship between real inward FDI and exchange rate. The study also suggested that exchange rate volatility need not be a source of worry for foreign direct investors in Nigeria..

Udoh & Egwaikhide, (2008) studied the impact of exchange rate volatility and inflation uncertainty on foreign direct investment in Nigeria for the period 1970-2005. Based on their study these two variables were estimated using GARCH model and the result showed that exchange rate volatility and inflation uncertainty exerted a significant influence on foreign direct investment.

3. Data and Model Specification

3.1. Data

This study uses annual data covering the period from 1981 to 2015 to investigate the effect of macroeconomic variables on foreign direct investment. Four widely used macroeconomic variables are employed: Real per capital income, consumer price index (inflation), real exchange rate and oil price. These factors have been identifying among the most significant determinants FDI in an oil producing country like Nigeria. Table 1 provides additional information on all the variables.

Table 1. List of variables and explanations.

VARIABLES	YEAR	EXPLANATION& APRIORI EXPECTATIONS	SOURCE	TYPE OF DATA
Foreign direct Investment (FDI)	1981-2014	Foreign direct investment (FDI) is an investment involving acquiring or creation of assets that is undertaken by foreigners or a joint venture with local governments with the main aim of creating a long-term relationship.	World, Development Indicators (World bank)	FDI, net inflows (BOP, current US\$).
Real Gross domestic product, (RGDP) We expect (+)	1981-2014	Real gross domestic product (GDP) is an inflation-adjusted measure that reflects the value of all goods and services produced by an economy in a given year, expressed in base-year prices, and is often referred to as "constant-price," "inflation-corrected" GDP or "constant dollar GDP. It is a proxy for economic growth.	World bank, Development Indicators, (World Bank)	GDP at constant 2005, In local currency (LCU).
Inflation We expect (-)	1981-2014	Frequent fluctuations in the level of prices reflects instable macroeconomic environment in a country	World bank Development (online)	Consumer price index 2010=100
Official, Exchange rate. For, depreciation (+) for appreciation (-)	1981-2014	Official exchange rate refers to the exchange rate determined by national authorities or to the rate determined in the legally sanctioned exchange market. It is calculated as an annual average based on monthly averages (local currency units relative to the U.S. dollar)	World bank, Development Indicators	Official exchange rate (LCU per US\$, Period average)
Oil price, We expect (+)	1981-2014	Oil price is the price for which crude oil per barrel is bought or purchased, it is the global oil price.	British, petroleum.	Brent oil price At \$.

Source: Author's Design.

3.2. Model Specification

Following the empirical literature in FDI, it is plausible to form the long-run relationship between in linear form, with a view of testing the relevant hypothesis as stated in section as follows:

$$fdi = f(infla, oilp, ExcR, rgdpc) \quad (1)$$

The above equation can be written in the econometric model and in their respective natural log form as thus; The above models can be re-written as an econometric model for this study as thus:

$$\ln fdi_t = \alpha + \beta_1 \ln infla_t + \beta_2 \ln oilp_t + \beta_3 \ln ExcR_t + \beta_4 \ln rgdpc_t + \varepsilon_t \quad (2)$$

In the production function is the natural log of foreign direct investment,, is the natural log inflation, is the natural log of real gross domestic the product, is natural log oil prices, is the natural log of exchange rate is the intercept, are the elasticities with respect to change to foreign direct investment.. ε_t is the stochastic error term.

3.3. Estimation Procedure

3.3.1. Unit Root Test

In time series analysis, before running the cointegration test the variables must be tested for stationarity. For this purpose, we use the conventional ADF tests. Therefore, before applying this test, we determine the order of integration of all variables using unit root tests by testing for null hypothesis (i.e has a unit root), and the alternative hypothesis is. This is to ensure that all the variables are integrated at I(1) to avoid spurious result.

3.3.2. Johansen Cointegration

This study adopts a dynamic vector autoregressive regression (VAR) which explores cointegration. The essence is to capture the causal dynamics relationship between FDI and macroeconomic variables, and at the same time to observe the long run and short dynamics. For instance, given a VAR with possible long run cointegration amongst a set of variables.

Therefore, we start with the Johansen cointegration equation which starts with the vector autoregression (VAR) of order is given by:

$$y_t = \mu + A_1 y_{t-1} + \dots + A_p y_{t-p} + \varepsilon_t \quad (3)$$

Where is a vector of variables under consideration in log form that are integrated at order one- commonly denoted $I(1)$, $n=5$ are the parameters to be estimated, are the random errors. This (VAR) can be re-written as;

$$\Delta y_t = \mu + \Pi y_{t-1} + \sum_{i=1}^{p-1} \Gamma_i \Delta y_{t-i} + \varepsilon_t \quad (4)$$

Where, $\Pi = \sum_{i=1}^p A_i - 1$ and

$$\Gamma_i = -\sum_{j=i+1}^p A_j \quad (5)$$

The above equation is a pure Johansen Cointegration test. Gregory and Hansen [29] noted that the Johansen test is a test for co-integration that allows for more than one co-integration relationship. If the coefficient matrix has reduced rank, then there exist matrices of and each with rank such that

$$\Pi = \alpha\beta' \quad (6)$$

Where is the number of co-integrating relationship, the element is is known as the adjustment parameters in the vector error correction model and each column of is a cointegrating vector. It can be shown that, for a given, the maximum likelihood estimator of define the combination of that yield the largest canonical correlations of with after correcting for lagged differences and deterministic variables when present. The two different likelihood ratio test of significance of these canonical correlations are the trace test and maximum eigenvalue test, shown in equation 5 and 6 respectively below

$$\lambda_{trace}(r) = -T \sum_{i=r+1}^n \ln(1 - \hat{\lambda}_i) \quad (7)$$

$$\lambda_{max}(r, r+1) = -T \ln(1 - \hat{\lambda}_{r+1}) \quad (8)$$

Here, T is the sample size and is the ordered eigenvalue from the matrix in equation 3 or largest canonical correlation. The trace tests the null hypothesis that the number of co-integrating vector against the alternative hypothesis of co-integrating vector where is the number of endogenous variables. The maximum eigenvalue tests the null hypothesis that there are cointegrating vectors against an alternative of Brooks [30].

3.3.3. Vector Error Correction Model (VECM) and Granger Causality Test

After testing for cointegration among the variables, the long run coefficients of the variables are the estimated. This study uses the Engle and Granger (1987) test augmented by the error correction term for detecting the direction of causality between the variables. The advantage of using vector error correction (VECM) modeling framework in testing for causality is that it allows for the testing of short-run causality through the lagged differenced explanatory variables and for long-run causality through the lagged ECM term. A statistically significant term represents the long-run causality running from the explanatory variables to the dependent variable. For instance, if two variables are non-stationary, but

become stationary after first differencing and are cointegrated, the p th-order vector error correction model for the Granger causality test assumes the following equation:

$$\Delta \ln X_t = \alpha_{10} + \sum_{i=1}^{p_{11}} \theta_{11i} \Delta \ln X_{t-i} + \sum_{i=1}^{p_{12}} \partial_{12j} \Delta \ln Y_{t-j} + \delta_{13} ECM_{t-1} + u_{1t} \quad (9)$$

$$\Delta \ln Y_t = \alpha_{20} + \sum_{i=1}^{p_{21}} \theta_{21i} \Delta \ln X_{t-i} + \sum_{i=1}^{p_{22}} \partial_{22j} \Delta \ln Y_{t-j} + \delta_{23} ECM_{t-1} + u_{2t} \quad (10)$$

Where θ and ∂ are the regression coefficients, is error term and p is lag order of x and y Table 6 indicates that the optimal lag order based on the Akaike information criteria (AIC) is 2. The presence of short-run and long-run causality can be tested. If the estimated coefficients of y in Eq. 2 is statistically significant, then that indicates that the past information of y (e.g FDI) has a statistically significant power to influence x (selected macroeconomic variables) suggesting that y Granger causes x in the short-run. The long-run causality can be found by testing the significance of the estimated coefficient of $()$. is the error correction term obtained from the cointegration model. The error coefficients indicate the rate at which the cointegration model corrects its previous period's disequilibrium or speed of adjustment to restore the long run equilibrium relationship. A negative and significant coefficient implies that any short run movement between the dependant and explanatory variables will converge back to the long run relationship. Indeed it recovers any long-run information that is partially lost in the system with differenced coefficient. So, that this terms are needed to gain model stability in the long run. Narayan and Smyths [31].

3.3.4. Variance Decomposition (VDC) and Impulse Response (IRF)

VDC technique focuses on the dynamics of series due to innovative shocks stemming from other series along with its own shock and also reflecting that whether the series is strongly impacted each other over the time periods. In this way, the use of VDC analysis could be more beneficial for the researchers to isolate the relative dynamic effects of its own shock and innovative shocks stemming from other independent variables towards dependent variable of the estimation process.

Also, IRF is likely to occur when we use a system of equation in order to evaluate the effects of standard deviation shocks causing each other. The advantage of IRF as it enables us to identify the impacts of shocks on variables over the time in a Vector Autoregressive (VAR) framework.

3.4. Diagnostic Test

To ensure the goodness of fit of the model, diagnostic tests are conducted. Diagnostic tests examine the model for serial correlation and heteroscedasticity.

4. Data Presentation and Analysis

Our analysis here divided into namely; descriptive statistics and empirical analysis.

4.1. Descriptive Statistics

Table 2. Summary Statistics of the variables (1981 to 2014).

	LFDI	LRGDP	LEXRAT	LCPI	LOIP
Mean	0.8951	30.9313	2.9986	2.3523	3.4110
Median	0.9740	30.7252	3.0886	3.1295	3.2767
Maximum	2.382	31.8502	5.0594	4.9047	4.6921
Minimum	-0.409	30.3551	-0.603	-0.894	2.5023
Std. Dev.	0.6929	0.4722	2.0113	1.9635	0.7069
Skewness	-0.008	0.714	-0.584	-0.336	0.6065
Kurtosis	2.5208	1.9760	1.9328	1.5797	2.0009
Jarque-Bera	0.3257	4.3802	3.5505	3.5008	3.4986
Probability	0.8497	0.1119	0.1694	0.1737	0.1739
Obs	34	34	34	34	34

Source: extract from eview9.

Table 2 above provides the summary descriptive statistics, namely, sample means, maximums, minimums, medians, standard deviations, skewness, kurtosis and the Jarque-Bera tests with their p-values. It is clear that all the statistics show the characteristics common with most time series, for instance, normality in the form of platykurtic there are a number of noticeable differences, between the variables. Firstly, real GDP has the largest unconditional average of 30.93% while FDI has the least unconditional average of 0.895%

The standard deviation shows the level of volatility in the variables. It displays the rate at which each variable deviates from the mean value. From the table above, the exchange rate is the most volatile at 2.011% while the real GDP is the less volatile 0.4722% (approximately).

The skewness measures the asymmetric nature of the data,

4.2. Empirical Result

4.2.1. Stationarity Test

Table 3. Unit root test.

Augmented Dickey Fuller (ADF)					
Variables	Levels		1st Diff		Order of Integration
	t-Stat.	P-value	t-Stat.	P-value	I(1)
<i>lnfdi</i>	-1.74225	0.4012	-4.23904	0.0023	I(1)
<i>lngdpc</i>	1.117166	0.9968	-3.4857	0.0153	I(1)
<i>lnexch</i>	-1.81396	0.3673	-3.49649	0.0149	I(1)
<i>lnpci</i>	-1.21011	0.6577	-3.33096	0.0219	I(1)
<i>lnoilp</i>	-0.0744	0.944	-4.19133	0.0026	I(1)

level of significance at 5% *level of significant at 1%.

Source: various computations from eview9.

All the data are transformed into the natural log form. To determine the order of integration of the variables, the ADF (augmented Dickey-Fuller) test which the null hypothesis is (i.e has a unit root), and the alternative hypothesis is are implemented. The results for the level and differenced variables are presented in Table 3

Skewness is a measure of the asymmetry of the probability distribution of a real-valued random variable about its mean. A normal distribution is symmetrical at point 0. If the value is greater than zero (>0) it's positively skewed, but if less than zero (<0) it is negatively skewed (Wooldridge, [32]). From table 2, FDI, CPI, and ExcR are negatively skewed whereas Real GDP, and Oil, are positively skewed.

Kurtosis measures the sharpness of the peak of a normal distribution curve. It is a measure of "tailedness" of the probability distribution of a real-valued random variable. If the value is approximately equal to 3, it is said to be mesokurtic distribution implying that it is normal distribution. If approximately greater than 3, it is leptokurtic distribution which has tails that asymptotically approach zero slowly and has more outliers than the normal distribution. While if approximately, less than 3 it is platykurtic which means that the distribution produces fewer and fewer outliers than the normal distribution (Wooldridge, [32]). Therefore, Table 2, all the series show evidence of platykurtic with values less than 3.

The Jarque-Bera is a test for normality of the distribution where the null hypothesis is that the distribution of the sample is a normal one. If the probability value of the Jarque-Bera test is significant, then the null hypothesis is rejected and the alternative is accepted which says that the sample is not normally distributed. If each variable is statistically significant (indicated by a zero probability), then the series are not normally distributed. Therefore the farther the probability statistic of a variable is to zero, the lower the value of its Jarque-Berastatistic and the more normally distributed it is and vice versa. From the results above, in Table 2 the Jarque-Bera tests show that the null hypothesis is strongly accepted for all the distribution. Hence, the variables can be described to be normally distributed.

The stationarity tests were performed first in levels and then in first difference to establish the presence of unit roots and the order of integration in all the variables. The results of the ADF stationarity tests for each variable show that the tests fail to reject the presence of unit root for data series in level, indicating that these variables are non-stationary in levels. The

first difference results show that these variables are stationary at 1% and 5% significance level (integrated of order one $I(1)$). As mentioned in the preceding sections, a linear combination of $I(1)$ series could be $I(0)$ if the series are cointegrated. We thus proceed to test for cointegration of the time series.

4.2.2. Lag Selection

Endogenous variables: LFDI LR GDP LEXRAT LCPI LOIP.

Table 4. VAR lag order selection criteria.

VAR Lag Order Selection Criteria						
Endogenous variables: LFDI LR GDP LEXRAT LCPI LOIP						
Lag	LogL	LR	FPE	AIC	SC	HQ
0	-96.450	NA	0.000479	6.545193	6.776481	6.620587
1	64.81657	260.10*	7.46e-0*	-2.2462	-0.8585*	-1.793865*
2	83.96127	24.7028	1.25E-07	-1.8684*	0.6757	-1.039132

* indicates lag order selected by the criterion, LR: sequentially modified LR test statistic (each test at 5% level), FPE: Final prediction error, AIC: Akaike information criterion, SC: Schwarz information criterion, HQ: Hannan-Quinn information criterion.

From the table, our optimal using Akaike information criterion is lag 2.

4.2.3. Johansen Cointegration

Table 5. Johansen cointegration result.

Hypothesis	Trace Stat	5% critical value	Max.Eigen Value	5% critical value
$fdi=f(rgdpc, exrat, cpi, oilp)$				
$r=0$	85.502*	69.819	47.806*	33.877
$r \leq 1$	37.696	47.856	17.942	27.584
$r \leq 2$	19.754	29.797	11.929	21.132
$r \leq 3$	7.825	15.495	7.713	14.265
$r \leq 4$	0.111	3.841	0.111	3.841

*level of significance at 10% **level of significance at 5% ***level significance at 1%

Source: various computation from eview9

The result of the cointegration test, based on the Johansen cointegration approach is presented in table 5. The author established lag 2 using akaike criterion (see table 4). Cointegration is tested on the long run relationship between the dependent variable exchange rate, and independent variables; real GDP, exchange rate, consumer price index and oil price. The table indicates that the test failed to accept the null hypothesis of no cointegration at 5% level of significance. Both the trace and Maximum Eigenvalue suggest that there is a common stochastic trend and as such the number of free random walks has been reduced by one. Therefore, FDI and macroeconomic variables have at least one common stochastic trend driving the relationship between them. The Johansen cointegration test shows this by comparing the statistic values with the critical value, a result is chosen at the value where the statistic is greater than the corresponding critical value. In this study, it is clear that there is at most 1 cointegrating equation in the model with both trace and maximum eigenvalue value suggest 5%

significance level. This implies that an equilibrium relationship exists among the cointegrating variables. In addition, no matter the fluctuation in the short run, these variables have the tendency to return to this equilibrium path in the long run.

Normalised cointegration Equation:

$$\Delta fdi = 811.0 + 28.303rgdpc + 0.2404ExcR - 3.073cpi + 16.909oilp + \varepsilon_t \quad (11)$$

[-4.883] [-0.26059] [-3.108] [-6.113]

Equation 11 represents the normalized cointegration equation, while the values in the bracket are the t-statistics. The equation reveals that real GDP, Exchange rate (ExcR), and Oil price ratio contributed positively significant to FDI inflow in Nigeria while consumer price index (inflation) has a negative but significant impact on the FDI. Indeed, all the variables are in agreement with the apriori expectations and the figures in bracket are the t-statistics.

The result reveals that red PC is statistically significant which means that 1% increase real GDP will lead to 28.303% change (increase) in FDI. This is in line with the existing documents that real GDP (market size) have a significant and positive impact on FDI inflows (Frey, [33]; Moore, [34]). However, Edwards [35] and Asiedu [36] reported that FDI and market size are not significantly positively related. For exchange rate, 1% increase in ExcR will lead to 0.2404% increase in FDI. The evidence here is mixed, however, Aliber [37] showed that when the currency of home country depreciates, its exchange rate increases and leads to increase in the FDI inflows in the host country. Thus, it can also be said that appreciation in the value of the currency of host country (fall in the exchange rate) leads to higher FDI inflows. Therefore, there exists a negative relationship between the exchange rate and FDI inflows in the host country.

Turning to inflation proxy by consumer price index, negative and statistically significant at 1% level. That is a 1% increase will lead to 3.24% decrease (change) in FDI. This leads to increase in the perceived risk of making an investment in such countries, which further leads to negative impact on FDI inflows. Further, when the rate of inflation is high, the real returns on investment reduce. (Schneider & Frey, [38]; Trevino & Mixon, [39]). Therefore, it can be concluded that FDI inflows and inflation are inversely related. However, recent evidence based on African data suggesting that countries with high inflation tend to attract less FDI (Onyeiwu and Shrestha, [40]). Oil price is positive and statistically significant at 1% level. It means that 1% increase in the oil price will lead to 16.909% in the FDI signifying the dominant role oil price on FDI. Since the presence of cointegration among variables means that causality must run from at least one direction, therefore, we apply error correction model, in company of variance decomposition and impulse response for more robust analysis.

4.3. Causality Test

Table 6. Long run and short run causality estimates.

VECM Granger Causality						
Type of Causality	Short run					Long run
Variables	D(LFDI)	D(LRGDP)	D(LEXRAT)	D(LCPI)	D(LOIP)	ECT
D(LFDI)		2.4868 (0.2884)	0.5991 (0.7411)	7.1997* (0.0273)	3.4396 (0.1791)	-0.1018** [-2.384]
D(LRGDP)	0.0016 (0.9992)		0.60814 (0.7378)	0.9392 (0.6252)	1.4183 (0.492)	-3.93E-05 [-0.0067]
D(LEXRAT)	0.4107 (0.8144)	5.7287** (0.057)		10.41*** (0.0055)	9.271*** (0.0097)	-0.0628** [-3.2147]
D(LCPI)	0.23223 (0.8904)	2.6035 (0.272)	2.0229 (0.3637)		1.50647 (0.4708)	0.01609 [1.9138]
D(LOIP)	10.326*** (0.0057)	3.1774 (0.2042)	1.3047 (0.5208)	11.665*** (0.0029)		-0.04231** [-2.4683]

Note: *, **, and *** indicate significance at 10%, 5% and 1%, respectively t-statistics in [] and P-values in ()

Source: various computation from eview9

This study uses the Granger causality test augmented by the error correction term for detecting the direction of causality between the variables. The optimal lag order selected based on the Akaike information Criteria (AIC) is 2. The VECM Granger causality divides causality results into a long run as well as the short run. The results regarding the VECM Granger causality test are reported in Table 6. The empirical results suggest that ECT_{t-1} has a negative sign and statistically significant in the Exchange rate, FDI, and oil price. This implies that there is bidirectional causality between FDI and exchange rate, and FDI and Oil price respectively in the long run. Bi-directional causality between FDI and exchange rate and FDI and Oil price indicate that they are complementary.

A number of causal interactions exist in the short run. The results in Table 6 show a unidirectional causality running from inflation to FDI, from FDI to Oil price. There are other causalities but our focus is between FDI and selected macroeconomic variables. In sum, the coefficients of ECM (-1) in table 6 is negative and significant at 1% level. The coefficients suggest that approximately 10% of the short-run disequilibrium is corrected in the long run

4.3.1. Variance Decomposition

Table 7. Variance Decomposition Analysis.

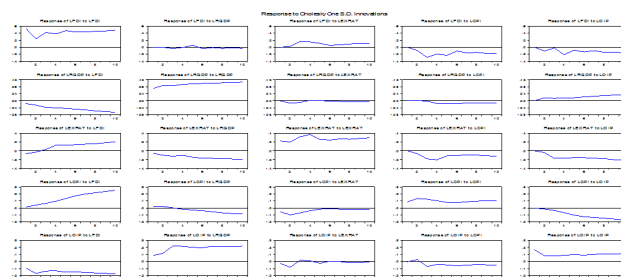
Variance Decomposition of LFDI:						
Period	S.E.	LFDI	LRGDP	LEXRAT	LCPI	LOIP
1	0.5307	100	0	0	0	0
2	0.5996	94.377	0.0011	0.1838	2.3309	3.107
3	0.8079	79.4939	0.2426	4.4177	14.0504	1.795
4	0.9492	73.5134	0.1779	5.7533	14.2093	6.346
5	1.0964	73.8393	0.3818	5.3128	15.1609	5.305
6	1.1936	75.5083	0.439	4.674	13.6307	5.748
7	1.2879	76.545	0.3818	4.2798	13.2659	5.527
8	1.3835	76.9656	0.3854	4.1703	12.635	5.843
9	1.4804	77.0783	0.3444	4.1057	12.4353	6.036
10	1.5787	77.1657	0.345	4.0613	12.1305	6.297

Source: extract from eview9

The variance decomposition in this study is used in forecasting and to investigate the dynamic relationship between FDI and macroeconomic variables. This study uses 10 years interval in other to provide a literal breakdown of the change in the value of the variable in a given period arising from a change in the same variable in addition to another variable in the previous period.

It is found in Table 7 that its (FDI) own shock explains 94.377% and 77.165% variation of FDI in 2 years and 10 years. This shows that the FDI is relatively greater in the short run than in the long run. We also found that change in real GDP has little influence on FDI which is explained by the innovative shock of 0.2426% and 0.345%. Interesting, there is significant influence from inflation and oil price in the short and long run with 14.05% and 12.13%, and 6.346% and 6.297% respectively. Whereas, exchange rate was less significant.

4.3.2. Impulse Response Function (VECM)



Source: Estimate from eview9.

Figure 1. Impulse response function Analysis.

The impulse response function serves the pivotal role in assessing how and to what extent shocks in macroeconomic variables influence FDI in Nigeria. Figure 2 displays the dynamic effects of one standard deviation of a particular from shock from FDI to shock on macroeconomic variables in Nigeria over a range of 10 years period. From Figure 2, the results of impulse response functions show that response in

FDI is due to forecast error stems from the exchange rate, however, the effect was in the third period. The response FDI responds negatively due to forecasting error in inflation and oil price respectively. This is because, in the first panel, the confidence band of impulse response function is below the line thereby confirming our earlier explanation on variance decomposition.

4.4. Discussion of Findings

Hypothesis 1

Trace and Max Engen statistic are significant at 5% level suggesting that there is a common stochastic trend and as such the number of free random walks has been reduced by one. Therefore, FDI and macroeconomic variables have at least one common stochastic trend driving the relationship between them. Also, the normalized cointegration shown in equation 11 revealed that real GDP, exchange rate, and oil price contributed positively significant inflation is negative and significant. Indeed, all the variables are in agreement with the apriori expectations. Also, the long run cointegration is confirmed through the error correction term which is correctly signed and significant. The intuition here is that the null hypothesis of no long run significant relationship FDI and macroeconomic variables are rejected. This finding is in line with these strands empirical studies that identified the long-run and short-run relationships among FDI, exports, imports, oil prices, exchange rate, gross fixed capital formation, RGDP, (Lv et al. [11]; Tsoukalas [12]; Bekhet and Al-Smadi, [13]; Bekhet and Mugableh, [14]; Hsiao and Hsiao, [15]; Iamsiraroj [16]; Pradhan et al. [17] These result showed evidence of significant relationships.

Hypothesis 2

This study uses the Granger causality test augmented by the error correction term for detecting the direction of causality between FDI and macroeconomic variables. The VECM Granger causality divides causality results into a long run as well as the short run. Table 6, reveals that there is long-run unidirectional causality between FDI and real GDP at 5% level of significance. Whereas, in the short run causality do not run from any direction. The intuition here is that real GDP causes FDI in Nigeria. We also found that change in real GDP has little or no significant influence on FDI which is explained by the innovative shock of 0.2426% and 0.345% reports. Thus we reject the null hypothesis that no causal significant relationship between FDI and real GDP in the long run Nigeria and vice versa in short run. These findings is in line with Obadan [24] who argued that market size, trade policies, and raw materials are very important determinants of FDI in Nigeria. Our study also follows the findings of Faras and Ghali (2009) who found that there was long-run elasticities among FDI and economic growth.

Hypothesis 3

The empirical results suggest that ECT_{t-1} has a negative sign and statistically significant in the Exchange rate and FDI indicating bidirectional causality between FDI and exchange rate at 5% level of significant indicating that they are complementary. However, there is no causal relationship

between in the short run. From Figure 2, the results of impulse response functions show that response in FDI is due to forecast error stems from the exchange rate, however, the effect was in the third period. Therefore, we reject the null hypothesis that no causal relationship between FDI and exchange rate in the long run in Nigeria. However, we cannot reject the null hypothesis of a causal relationship between the variables in the short run.

Hypothesis 4

The empirical results suggest that ECT_{t-1} has a negative sign and statistically significant in the inflation and FDI indicating unidirectional causality between FDI and inflation at 5% level of significant. There is also, a noticeable unidirectional causality running from inflation rate captured by consumer price index to FDI in the short run. Analyzing further, variance decomposition and impulse response function (table 7 and figure 2) give a more robust insight about the influence of inflation rate which records 15.16% and 12.13% in the short and long run respectively. Therefore, we reject the null hypothesis that of no causal significant relationship between the inflow of FDI and Consumer price index in Nigeria.

Hypothesis 5

The empirical results suggest that ECT_{t-1} has a negative sign and statistically significant at 5% level of FDI and oil price. This implies that there is bidirectional causality between FDI and Oil price respectively in the long run. It indicates that they are complementary. Even though we do not record any causal relationship in the short run dynamics, table 7 shows that variance decomposition and consistent with impulse response function are in agreement with the causality result in the long run. The intuition here is that we reject the null hypothesis that there is no causal relationship between changes oil price and FDI in Nigeria. However, in the short, we cannot reject the null hypothesis. Our findings follow Razmi and Behname [22] who made an experiment on FDI determinants and oil effects on foreign direct investment from Islamic and found that in (Iran, Qatar, Saudi Arabia and Kuwait) oil extraction has a negative and significant impact on FDI. This is because investors estimate that in the host countries there is a dependency between government income and oil sale. This dependency shows that with a sudden change in oil price, economic risk in these countries will increase. Economic crisis in the years 1997, 1998 and 1999 in Asian countries had a negative effect on FDI.

5. Conclusion and Policy Recommendations

Developing economies especially the African countries have sought to increase FDI in recent years. Policies that are friendlier to attracting FDI have been implemented across the countries. These include setting up free-zone boards as well as liberalizing the economy. Even some countries have resort to perpetual transition to a democratic system of government. All these developments are aimed at fostering economic

growth on the continent. However, none has given a credible result in the long run. Also, policies aimed at improving stock improving the level of infrastructure on the continent, opening up and liberalizing trade, strengthening institutions and reducing macroeconomic instability will be beneficial for FDI flows to the continent. Finally, policies aimed at attracting FDI are necessary because higher FDI flows can cause more banking and financial development. Also, government should strengthen the political institutions and adopt democratic principles that will ensure stability within the polity. The current crisis in the Niger-Delta region has been a major obstacle to crude oil production. The restoration of peace in the region will, in turn, too more foreign investment to Nigeria. The surge in FDI to Nigeria since 1999 has partly been attributed to the democratic rule and relative peace within the system. Fourthly, the government should allow the exchange rate to depreciate further since it will reduce the dollar price of some ailing indigenous industries, thereby attracting more foreign investment in the form acquisition or mergers. Finally, the government should invest more in infrastructure (like power, energy, transportation, telecommunication, etc.) so as to enhance the competitiveness of the environment of investment and ultimately increase FDI inflows. All of these should be complemented with the on-going war on corruption.

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