

Causality Analysis of the Impact of Foreign Direct Investment on GDP in Nigeria.

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ABSTRACT: This study used a Cointegration VAR model to study the Contemporaneous Long $\hat{\sigma}$ run dynamics of the impact of foreign direct Investment (FDI) on Growth Domestic Products (GDP) with other four macroeconomic variables in the Nigerian Economy for the period of January 1970 to December 2004. The Unit Root Test suggests that all the variables are integrated of order 1. The VAR (3) model were appropriately Identified using AIC information criteria and the VECM (2) model with cointegration relation of exactly one. The study further investigate the causal relationship using the Granger Causality analysis of VECM which indicates a uniódirectional causal relationship between GDP and FPI at 5% as in inline with other studies of Basu et al.(2003). The results of Granger Causality Analysis also show that some of the variables are Granger Causal of one another, at 5% level of significance. Having established the fact that foreign direct investment has positive impact on growth domestic product, government should strategize policies that would enhance foreign direct investment in Nigeria.

Key Words: Cointegration, VAR, VECM, and Granger Causality

INTRODUCTION

The introduction of co integration techniques in modeling and analyzing macro economics variables has tremendously changed the nature and direction of modeling of macro economics system (or sub systems). It provides an alternative means to assess the extent to which the variables under consideration are integrated. Specifically, if GDP, FDI and four other macro economic variables are integrated of order one, then, they will be cointegrated or have a long run equilibrium relationship. The co integration relations are used as a tool for discussing the existence of long-run economic relations and various hypotheses are then tested in view of the statistical variations of the data. The use of Vector Autoregressive Models (VAR) and Vector Error Correction Models (VECM) for analyzing dynamic relationships among financial variables has become common in the literature, (Granger 1981; Engle and Granger, 1987; MacDonald and Power, 1995; Barnhill, *et al.*, 2000). The popularity of these models has been associated with the realization that relationships among financial variables are so complex that traditional time-series models have failed to fully capture.

The manifestation of economic crises in most of developing countries including Nigeria in the late 1970s and early 1980s made the authorities of these countries to change their attention toward macro economic policy and its relation

to economic growth by increasing effort toward attracting foreign direct investment (Adeolu, 2007). Caves (1996) observes that the rationale for increased efforts to attract more FDI stems from the belief that FDI has several positive effects. Among these are productivity gains, technology transfers, and the introduction of new processes, managerial skills and know-how in the domestic market, employee training, international production networks, and access to markets. However, there have been some studies on investment and growth in Nigeria with varying results and submissions. Ariyo (1998) studied the investment trend and its impact on Nigeria's economic growth over the years. He found that only private domestic investment consistently contributed to raising GDP growth rates during the period considered (1970-1995). Furthermore, there is no reliable evidence that all the investment variables included in his analysis have any perceptible influence on economic growth. He therefore suggests the need for an institutional rearrangement that recognizes and protects the interest of major partners in the development of the economy. Oyinlola (1995) conceptualized foreign capital to include foreign loans, direct foreign investments and export earnings. Adelegan (2000) explored the seemingly unrelated regression model to examine the impact of FDI on economic growth in Nigeria and found out that FDI is pro-consumption and pro-import and negatively related to gross domestic investment.

Akinlo (2004) found that foreign capital has a small and not statistically significant effect on economic growth in Nigeria.

The objective of this study is, therefore to conduct Engle Granger Causality test to investigate the impact of foreign direct investments on gross domestic product in Nigeria, using Vector error correction Model (VECM) techniques.

Review of the causal Relationship between FDI and GDP: One of the most important concepts of causality was introduced by Granger (1969) and has become quite popular in the economic literature. This study specifically is interested in the literature that focused more directly on the causal relationships between FDI and growth and, at least, six studies have tested for Granger causality between the two series using different samples and estimation techniques. Zhang (2001) looks at 11 countries on a country-by-country basis, dividing the countries according to the time series properties of the data. Tests for long run causality based on an error correction model, indicate a strong Granger-causal relationship between FDI and GDP-growth. For six counties where there is no cointegration relationship between the log of FDI and growth, only one country exhibited Granger causality from FDI to growth. Chowdhury and Mavrotas (2003) take a slightly different route by testing for Granger causality using the Toda and Yamamoto (1995) specification, thereby overcoming possible pre-testing problems in relation to tests for cointegration between series. Using data from 1969 to 2000, they find that FDI does not Granger cause GDP in Chile, whereas there is a bi-directional causality between GDP and FDI in Malaysia and Thailand.

Finally the study by Basu *et al.* (2003) addresses the question of the two-way link between growth and FDI. Allowing for country specific cointegrating vectors as well as individual country and time fixed effects they find a cointegrated relationship between FDI and growth using a panel of 23 countries. Basu *et al.* emphasize trade openness as a crucial determinant for the impact of FDI on GDP; they find two-way causality between FDI and growth in open economies, both in the short and the long run, whereas the long run causality is

unidirectional from GDP to FDI in relatively closed economies.

MATERIALS AND METHODS

The detailed overview of procedures and methodology to be implemented in this research work is hereby presented. The theoretical model, which also serves as a basic frame work of our statistical analysis, is the Vector Autoregressive model of order p, which is denoted by VAR (P) and is given by
$$Y_t = \hat{\alpha} + D_t + \psi + \phi_1 Y_{t-1} + \phi_2 Y_{t-2} + \dots + \phi_p Y_{t-p} + \varepsilon_t \quad (2.1)$$

Equation (2.1) can be written as

$$\phi(L)Y_t = \hat{\alpha} + D_t + \psi + \varepsilon_t$$

Where $\phi(L) = 1 - \sum_{j=1}^p \phi_j L^j$,

$Y_t = (Y_{1t}, Y_{2t}, \dots, Y_{kt})'$ is a set of k^{th} time series variables, $\hat{\alpha}$ is the constant term, D_t is the regressors associated with deterministic terms, ψ is the seasonal dummies and structural breaks and $\varepsilon_t = (\varepsilon_{1t}, \varepsilon_{2t}, \dots, \varepsilon_{kt})'$ is an unobserved zero means independent white noise process with time invariant and positive definite covariance matrix $E(\varepsilon_t \varepsilon_t') = \Sigma_k$ and

$\phi(L) = 1 - \phi_1 L - \phi_2 L^2 - \dots - \phi_p L^p$ is a matrix of a lag polynomial with $k \times k$ coefficient matrices, $\phi_j, j = 1, 2, \dots, p$.

When interest centre on cointegration relation the more convenient model to use is Vector Error Correction model (VECM) which is given by:

$$\Delta Y_t = \pi y_{t-1} + \Gamma_1 \Delta y_{t-1} + \dots + \Gamma_{p-1} \Delta y_{t-p+1} + \hat{\alpha} + D_t \psi + \varepsilon_t \quad (2.2)$$

Where $\pi = -(\mathbf{I}_n - \phi_1 - \phi_2 - \dots - \phi_p)$ and $\Gamma_j = -(\phi_{j+1} + \dots + \phi_p)$ for $(j = 1, 2, \dots, p-1)$

Since ΔY_t does not contain stochastic trends by our assumption that all variances should be I(1), the mean term πX_{t-1} is the only one which includes I(1) variables. Hence, πY_{t-1} must also be I(0) thusit contain the cointegration relations. The $\Gamma_j (j = 1, 2, \dots, 1-p)$ are often referred as the short run term while πY_{t-1} is sometimes called the long run term. The model in (2.2) is abbreviated as VECM (P-1).

Unit Root and Stationarity Tests: Quite a number of unit root test have been developed with a view to determining whether the series are stationary, in this research we consider two tests that test the null hypothesis of Unit Root against the alternative of stationary. These are: Augmented Dickey- Fuller (ADF) Unit Root Test and the Dickey Fuller-Generalized Least Square (DF-GLS) Test. And KPSS Test with the null hypothesis of Stationarity against alternative of Unit Root.

VAR Lag Order by Selection Criterion and Cointegration Test: The following criteria are often used:

- (i) This is the Akaike information criterion Akaike. (1974)

$$AIC = \ln \frac{1}{T} \sum_{t=1}^T \left(\hat{u}_t^{(p)} \right)^2 + m \frac{2}{T}$$

- (ii) Alternatives are the Bayesian criterion of Gideon (1978)

$$SC = \ln \frac{1}{T} \sum_{t=1}^T \left(\hat{u}_t^{(p)} \right)^2 + m \frac{\ln T}{T}$$

- (iii) the criterion developed by Edward and Quinn (1979)

$$HQ = \ln \frac{1}{T} \sum_{t=1}^T \left(\hat{u}_t^{(p)} \right)^2 + m \frac{2 \ln(\ln T)}{T}$$

There are several methods available for conducting the cointegration test. The most widely used methods include the residual based Engle and Granger (1987) test and Maximum likelihood base Johansen (1991) test.

Model Checking: Once a model has been specified its adequacy is usually checked with a series of tests. There is need to implement some of the statistic test in order to obtain valid and accurate results. Most of these model checking tools are based on the residuals of the model. These includes: Autoregressive Condition Heteroskedastic-Lagrange Multiplier (Arch ó Lm), Breusch ó Godfrey Lagrange Multiplier (Lm) Test, Portmanteau Test for Autocorrelation, and Jarque- Bera Test of Normality.

Stability Analysis: Parameters are constant through out the sample period, is a key assumption in econometric models. In this study the recursive residuals test that is CUSUM TEST are adopted to check the validity of this assumption.

The Cusum Test: The Cusum test according to Brown *et al.* (1975) cited in Lutkepohl *et al.* (2005) is based on the cumulative sum of recursive residuals. The test plots the cumulative sum together with the 95% critical line.

The test finds parameter instability if the cumulative sum goes outside the area between the two critical lines, up to a particular period t.

$$CUSUM = \sum_{r=k+1}^T \frac{W_r}{s}, \quad r = k + 1, \dots, T$$

Where W is the recursive model, s is the standard error of the regression fitted to all T sample point, k is the number of coefficient to be estimated.

The significance of any departure from the zero line is assessed by reference to a pair of 95% significance lines. The distance which increases with Movement w_r outside the critical lines is suggesting coefficient instability.

On the other hand the CUSUM square test is based on the statistic

$$CUSUM - SQ = \frac{\sum_{r=k+1}^T w_r^2}{\sum_{r=k+1}^T w_r^2}$$

If the CUSUM ó SQ cross the pair of 95% critical lines it indicate the structural instability.

The Granger Causality Analysis: The causality concept introduce by Granger (1969) is perhaps the most widely discussed form of causality in the econometrics literatures, Granger defines a variable y_t to be cause by another time series variables x_t if the former variables can be predicted using past values of x_t in addition to the all other relevant information needless to say, the correct estimation procedure would be to include all

independent variables indicated by the relevant economic theory.

Excluding appropriate variables may yields irrelevant and useless results. Granger considers a system of the general form.

$$\begin{pmatrix} y_{1t} \\ y_{2t} \end{pmatrix} = CD_t + \sum_{i=1}^p \begin{pmatrix} \alpha_{11} & \alpha_{12} \\ \alpha_{21} & \alpha_{22} \end{pmatrix} \begin{pmatrix} y_{1t-1} \\ y_{2t-1} \end{pmatrix} + \begin{pmatrix} u_{1t} \\ u_{2t} \end{pmatrix}$$

In the model set up, y_{1t} does not Granger cause y_{2t} if and only if

$$\alpha_{2i} = 0, \quad i = 1, 2, \dots, p$$

In other words, y_t Granger cause x_t if y_t can help forecast x_t . if y_t does not cause x_t and x_t does not cause y_t then both y_t and x_t

$$\begin{pmatrix} \Delta X_t \\ \Delta Y_t \end{pmatrix} = \begin{pmatrix} \beta_1 \\ \beta_2 \end{pmatrix} + \sum_{i=1}^p \begin{pmatrix} \alpha_{11} & \alpha_{12} \\ \alpha_{21} & \alpha_{22} \end{pmatrix} \begin{pmatrix} \Delta X_{t-1} \\ \Delta Y_{t-1} \end{pmatrix} + \Pi \begin{pmatrix} X_{t-1} \\ Y_{t-1} \end{pmatrix} + \begin{pmatrix} u_{1t} \\ u_{2t} \end{pmatrix}$$

Where $\begin{pmatrix} X_{t-1} \\ Y_{t-1} \end{pmatrix}$ is an error correction term drive from long run cointegrating relationship, u_{1t} and u_{2t} are serially independent errors with mean zero and finite covariance matrix Σ_x . The decision criteria is that accept H_0 (no causal relation ship between variables) if p δ value is greater than the significance level, otherwise we reject the null- hypothesis and accept the alternative hypothesis (there exist causal relationship between variables) if p δ value is less than significance level α .

Data Analysis: Our target in this paper is to establish whether there is causality relation ship between the Gross domestic product (GDP) and Foreign direct investment in Nigeria(the emphasis is on GDP and FDI). The data for the analysis consist of annual observations of six macro economic variables in the Nigerian

are independent .if y_t cause x_t and x_t cause y_t , it said that feedback exist between x_t and y_t .

A Wald test statistic divided by the number of restriction is used in conjunction with an F-distribution for testing the restriction (Lueikepohl (1991). If the F- statistic is greater than the critical value for an F δ distribution, then null hypothesis is rejected, that y_t does not Granger cause x_t . The role of y_t and x_t can reverse to test Granger causality from x_t to y_t .

If the time series variable are not stationary but integrated of the same order that is I(1) and cointegrated. Granger causality is implemented by specifying PH order VECM follows.

economy for the period of 1970 δ 2004: IFR = Inflation rate (measure by consumer price index), FDI= Foreign Direct investment, GDP= Real Gross domestic product, INR= Interest rate, COP= Crude oil production, ENC = Energy consumption, obtained from the central bank of statistical bulletin vol. 16, 2005 for the period of 1970 δ 2004. Two statistical softwares are used for the empirical data analysis namely Gretl and Jmulti.

Time Plot of the Variables: The time series plot of all the variables are carried out where by each variable is plotted against time. These plots are shown in Figures 1 and 2. These plots were then examined (as we can see the entire plots have no seasonality), the variables are not covariance stationary. The plots of two variables are trending up ward. We take the log in order to stabilize their variances (GDP=l_GDP, FDI=l_FDI). The plot of the variables shows that the series are not mean reverting.

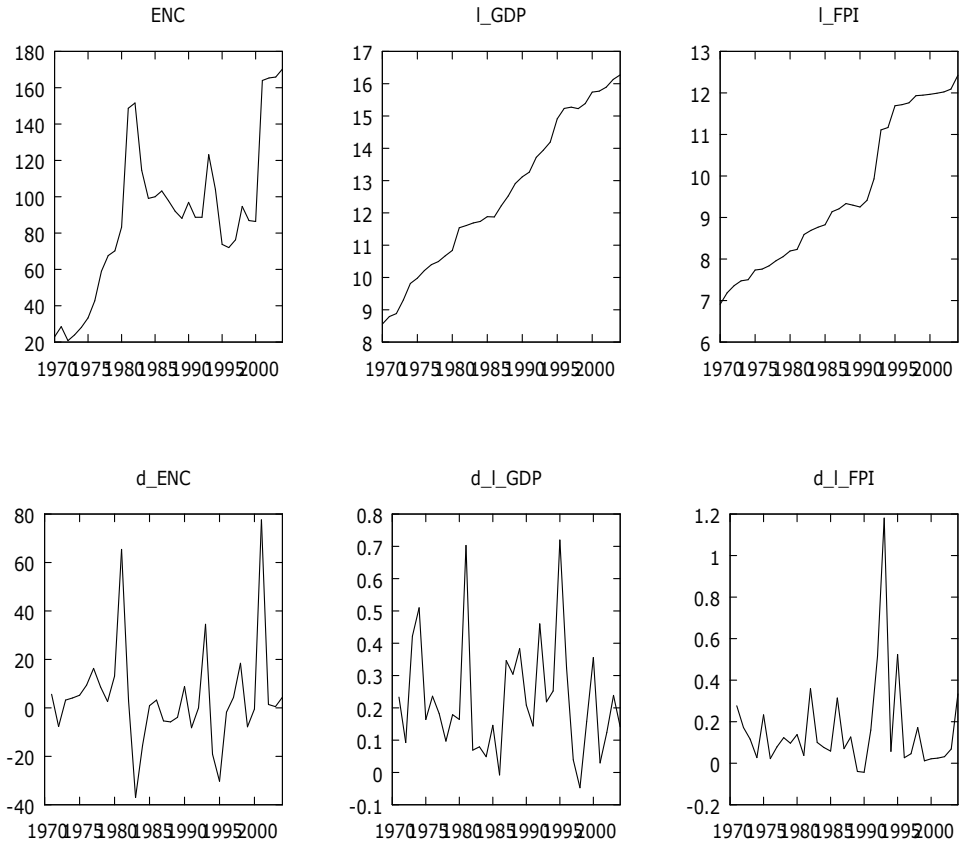


Fig. 1: Plots of Variables at Levels and First Difference

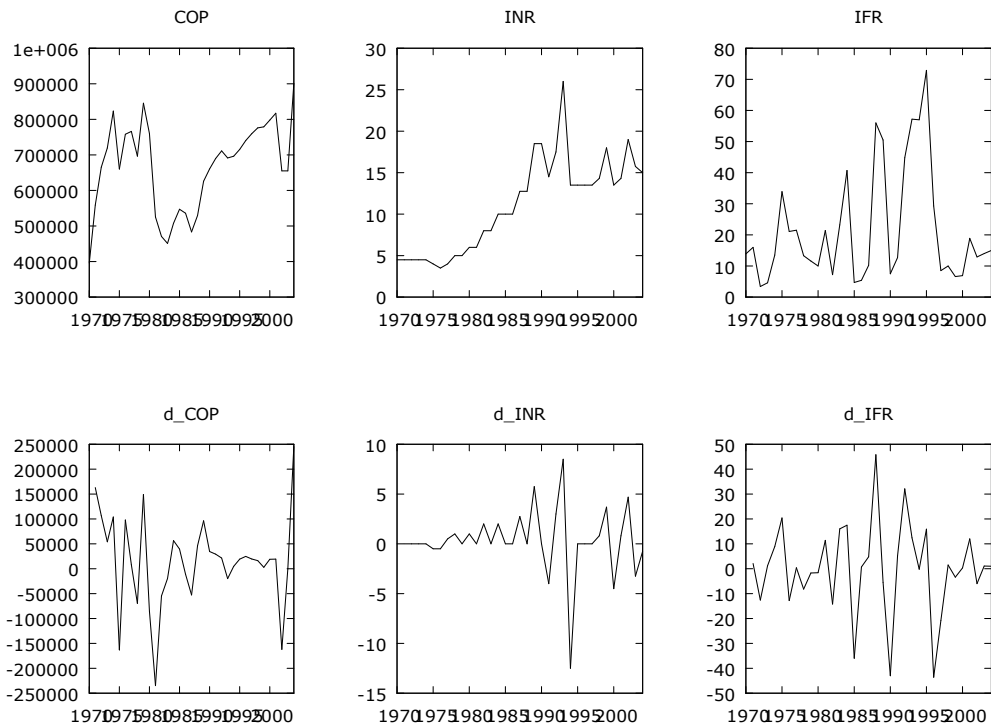


Fig. 2: Plots of Variables at levels and First Difference

Determination the Lag Order of the Variables: In this study the ADF test down procedure is applied to determine the lag order of each variable, the maximum lag of 10 to 1 is used in this study. The results are as in Table 1.

Variable IFR has Lag order of 1 for it to be stationary in the unit root test. The variable logGDP has Lag order of 0 for it to be stationary in the unit root test. The variable log FPI has Lag order of 0 for it to be stationary in the unit root test. The variable INR has lag order of 1 for it to be stationary. Variable COP has lag order of 0 and 3 for it to be stationary in the unit root test. Variable ENC has lag order of 1 for it to be stationary in the unit root test.

Unit Root Test: Tables 1 and 2 summarize the results of unit root test. From the results, all the variables are non stationary at levels but stationary in the first difference since critical values are less than test statistics at the levels but critical values are greater than test statistics in the first difference for both ADF and ADF - GLS test leading to non rejection of null hypothesis at these levels but null hypothesis is rejected at first difference. Hence the series are integrated of order one (1). Also KPSS test (Table 3) reject the null hypothesis at levels but null hypothesis is accepted at first difference

Table 1: The ADF unit root test for identification of order of integration of the variables

Var Trend	Level		First Difference	
	t	stat	Const	Const & Trend
IFR	-3.2624	-3.2260	-5.7776	-5.6907
LnGDP	-0.7291	-2.1934	-5.1590	-5.159
LnFPI	-0.0954	-1.7290	-4.7923	-4.7357
INR	-1.8609	-3.2548	-7.1167	-7.0088
COP	-2.4934	-2.1525	-5.6342	-5.6342
ENC	-1.3000	1.9990	-5.118	-5.0289
Critical Val 5%	-2.93	-3.50	-2.93	-3.50
1%	-3.58	-4.15	-3.58	-4.15

Table 2: ADF- GLS Test for identification of order of integration

VAR Trend	Levels		First Difference	
	Const	Const &	Const Trend	Const &
IFR	-3.1891	-	-5.7694	-5.7887
3.2775			-5.2826	-5.3260
Log GDP	1.4291	-	-4.6547	-4.8491
2.2999			-7.2026	-7.2117
Log FPI	1.0748	-	-3.4319	-4.5854
1.7245				
INR	-1.0989	-2.5832	-5.2063	-5.2090
COP	-1.6238	-		
2.3861				
ENC	-1.0471	-		
2.3893				
5%	-3.58	-	-3.58	-3.46
3.46			-2.93	-3.77
1%	-2.91	-		
3.77				

Table 3: KPSS Unit Root Test for identification of order of integration

Var	levels		First Difference	
	Const	Const & Trend	Const	Const & Trend
IFR	0.30011	0.203227	0.0320449	0.0267881
LnGDP	1.81737	0.186698	0.07132249	0.0598517
LnFPI	1.8356	0.217995	0.091847	0.069839
INR	1.46294	0.230544	0.0810536	0.0527462
COP	0.914337	0.202979	0.0862713	0.0861209
ENC	1.01505	0.299511	0.0661834	0.0709819
Critical val. 5%	0.463	0.146	0.463	0.146

VAR Model Identification

We estimate VAR model of l_GDP , IFR , l_FDI , INR , COP and ENC . With number of lags order of 3 bases on information criteria the values of AIC, HQC, and BIC are given by the result in Table 4. VAR system, maximum lag order 3, the

asterisks below indicate the best (that is, minimized) values of the respective information criteria, AIC = Akaike criterion, BIC = Schwartz Bayesian criterion and HQC = Hannan-Quinn criterion.

Table 4: Lag order selection

lags	loglik	p(LR)	AIC	BIC	HQC
1	-718.86004		47.553753	49.477531*	48.191431
2	-672.06921	0.00000	46.879326	50.452057	48.063585
3	-609.71422	0.00000	45.232139	50.453823	46.962979*

We use AIC Criteria to obtain the most parsimonious model for the data. After determining the order of VAR model the next stage consist of determining the inclusion or exclusion of the constant matrices ∂ , D_t and ψ as in the following model.

$$\begin{pmatrix} l_GDP_t \\ l_FDI_t \\ IFR_t \\ INR_t \\ COP_t \\ ENC_t \end{pmatrix} = \begin{pmatrix} \partial_1 \\ \partial_2 \\ \partial_3 \\ \partial_4 \\ \partial_5 \\ \partial_6 \end{pmatrix} + \begin{pmatrix} \phi_{11} & \phi_{12} & \phi_{13} & \phi_{14} & \phi_{15} & \phi_{16} \\ \phi_{21} & \phi_{22} & \phi_{23} & \phi_{24} & \phi_{25} & \phi_{26} \\ \phi_{31} & \phi_{32} & \phi_{33} & \phi_{34} & \phi_{35} & \phi_{36} \\ \phi_{41} & \phi_{42} & \phi_{43} & \phi_{44} & \phi_{45} & \phi_{46} \\ \phi_{51} & \phi_{52} & \phi_{53} & \phi_{54} & \phi_{55} & \phi_{56} \\ \phi_{61} & \phi_{62} & \phi_{63} & \phi_{64} & \phi_{65} & \phi_{66} \end{pmatrix} \begin{pmatrix} l_GDP_{t-1} \\ l_FDI_{t-1} \\ IFR_{t-1} \\ INR_{t-1} \\ COP_{t-1} \\ ENC_{t-1} \end{pmatrix} + \begin{pmatrix} \phi_{11}^2 & \phi_{12}^2 & \phi_{13}^2 & \phi_{14}^2 & \phi_{15}^2 & \phi_{16}^2 \\ \phi_{21}^2 & \phi_{22}^2 & \phi_{23}^2 & \phi_{24}^2 & \phi_{25}^2 & \phi_{26}^2 \\ \phi_{31}^2 & \phi_{32}^2 & \phi_{33}^2 & \phi_{34}^2 & \phi_{35}^2 & \phi_{36}^2 \\ \phi_{41}^2 & \phi_{42}^2 & \phi_{43}^2 & \phi_{44}^2 & \phi_{45}^2 & \phi_{46}^2 \\ \phi_{51}^2 & \phi_{52}^2 & \phi_{53}^2 & \phi_{54}^2 & \phi_{55}^2 & \phi_{56}^2 \\ \phi_{61}^2 & \phi_{62}^2 & \phi_{63}^2 & \phi_{64}^2 & \phi_{65}^2 & \phi_{66}^2 \end{pmatrix} \begin{pmatrix} l_GDP_{t-2} \\ l_FDI_{t-2} \\ IFR_{t-2} \\ INR_{t-2} \\ COP_{t-2} \\ ENC_{t-2} \end{pmatrix} \\
 + \begin{pmatrix} \phi_{11}^3 & \phi_{12}^3 & \phi_{13}^3 & \phi_{14}^3 & \phi_{15}^3 & \phi_{16}^3 \\ \phi_{21}^3 & \phi_{22}^3 & \phi_{23}^3 & \phi_{24}^3 & \phi_{25}^3 & \phi_{26}^3 \\ \phi_{31}^3 & \phi_{32}^3 & \phi_{33}^3 & \phi_{34}^3 & \phi_{35}^3 & \phi_{36}^3 \\ \phi_{41}^3 & \phi_{42}^3 & \phi_{43}^3 & \phi_{44}^3 & \phi_{45}^3 & \phi_{46}^3 \\ \phi_{51}^3 & \phi_{52}^3 & \phi_{53}^3 & \phi_{54}^3 & \phi_{55}^3 & \phi_{56}^3 \\ \phi_{61}^3 & \phi_{62}^3 & \phi_{63}^3 & \phi_{64}^3 & \phi_{65}^3 & \phi_{66}^3 \end{pmatrix} \begin{pmatrix} l_GDP_{t-3} \\ l_FDI_{t-3} \\ IFR_{t-3} \\ INR_{t-3} \\ COP_{t-3} \\ ENC_{t-3} \end{pmatrix} + \begin{pmatrix} \varepsilon_{1t} \\ \varepsilon_{2t} \\ \varepsilon_{3t} \\ \varepsilon_{4t} \\ \varepsilon_{5t} \\ \varepsilon_{6t} \end{pmatrix}$$

From the model above, we note that in this model (i) there are no exogenous variables, (ii) there is a constant term but no trend or dummy variables for either seasonality or structural breaks and (iii) the number of endogenous lag is 3. The absence of dummy variables is easily explain; tests shows that (a) the periodicity of the macroeconomic variables is 1 and (b) there are no structural breaks in the data. Hence,

structural breaks and seasonal dummies should not be included in the VAR model.

Johansen Test for Cointegration Rank: We have applied Johansen trace test and maximum likelihood max test in order to determine the Cointegration rank of our variables since it is one of the conditions to model with VECM that there must be Cointegration relationship. The results for the test are presented in the Table 5.

Table 5: Johanson Test for cointegration rank

Rank	Eigenvalue	Trace test	p-value	Lmax test p-value
0	0.83389	124.03	0.0001	59.238
1	0.64887	64.793	0.1167	0.0000
2	0.35786	30.255	0.7076	34.538
3	0.25813	15.638	0.7424	0.0377
4	0.13426	5.7843	0.7229	14.617
5	0.030627	1.0265	0.3110	0.7761
				9.8534
				0.7601
				4.7578
				0.7707
				1.0265
				0.3110

From Table 5 results, the cointegrating rank is 1 base on the p- value of trace test since the first null hypothesis that can not be rejected is at rank 1.

Results of Cointegration Relations

$$\hat{\beta} = \begin{pmatrix} 1.000 \\ -0.873 \\ -0.115 \\ -0.003 \\ -0.006 \\ -0.000 \end{pmatrix} \text{ and } \hat{\alpha} = \begin{pmatrix} -0.487 \\ 0.861 \\ 11.342 \\ 34.431 \\ 51.287 \\ -199700.724 \end{pmatrix}$$

The above results show that the cointegration relation with restricted constant is

$$ec_t^{ML} = -1.573 + GDP - 0.873FPI - 0.115INR - 0.003IFR - 0.006ENC - 0.000COP$$

or

$$GDP = 1.573 + 0.873FPI + 0.115INR + 0.003IFR + 0.006ENC$$

The equation above can be interpreted as follows: the coefficient 0.873 of the value of Foreign Direct Investment in Nigeria (FPI) is the estimated out put elasticity because Gross Domestic Product (GDP) and Foreign Direct Investment (FPI) both appear in logarithms (Lutkepohl, 2005). For a 1% GDP increase obtained in Nigeria will induce a similar 0.115%

increase in interest rate(INR) , 0.003% inflation rate(IFR), 0.006% energy consumption (ENC) and 0.000% of crude oil production(COP).

VECM (2) Representation: The VECM representation of the VAR 3 model is given in equation below. The complete VECM (2)

Equation can represent as follows:

$$\begin{bmatrix} \Delta GDP_t \\ \Delta FDI_t \\ \Delta INR_t \\ \Delta IFR_t \\ \Delta ENC_t \\ \Delta COP_t \end{bmatrix} = \begin{bmatrix} -0.487 \\ 0.861 \\ 11.342 \\ 34.431 \\ 51.287 \\ -199700.7 \end{bmatrix} \begin{bmatrix} 1.000 & -0.873 & -0.115 & -0.003 & -0.006 & -0.000 \end{bmatrix} \begin{bmatrix} \Delta GDP_{t-1} \\ \Delta FDI_{t-1} \\ \Delta INR_{t-1} \\ \Delta IFR_{t-1} \\ \Delta ENC_{t-1} \\ \Delta COP_{t-1} \end{bmatrix} + [-1.573]$$

$$+ \begin{bmatrix} 0.315 & -0.477 & -0.023 & 0.002 & -0.002 & -0.000 \\ 0.567 & 1.357 & 0.018 & 0.002 & 0.004 & 0.000 \\ 1.808 & 6.461 & 0.303 & 0.108 & 0.061 & 0.000 \\ 4.702 & 50.168 & 1.425 & 0.096 & 0.140 & 0.000 \\ 45.915 & 61.961 & 0.976 & 0.108 & 0.295 & 0.000 \\ 34587.6 & -182531.5 & -7382.5 & -574.8 & -2752.2 & 0.000 \end{bmatrix} \begin{bmatrix} \Delta GDP_{t-1} \\ \Delta FDI_{t-1} \\ \Delta INR_{t-1} \\ \Delta IFR_{t-1} \\ \Delta ENC_{t-1} \\ \Delta COP_{t-1} \end{bmatrix}$$

$$+ \begin{bmatrix} 0.193 & 0.075 & -0.010 & 0.004 & 0.001 & 0.000 \\ -0.351 & 0.556 & 0.034 & 0.001 & 0.007 & 0.000 \\ 1.419 & 7.633 & 0.030 & -0.013 & 0.069 & 0.000 \\ -23.820 & 26.734 & 2.889 & -0.297 & 0.503 & 0.000 \\ -18.875 & -7.698 & 2.514 & 0.256 & 0.204 & 0.000 \\ 53123.4 & 174152.8 & 3971.6 & -780.6 & -2276.6 & -0.708 \end{bmatrix} \begin{bmatrix} \Delta GDP_{t-2} \\ \Delta FDI_{t-2} \\ \Delta INR_{t-2} \\ \Delta IFR_{t-2} \\ \Delta ENC_{t-2} \\ \Delta COP_{t-2} \end{bmatrix} + \begin{bmatrix} U_{1t} \\ U_{2t} \\ U_{3t} \\ U_{4t} \\ U_{5t} \\ U_{6t} \end{bmatrix}$$

VECM Model Checking: The following tests to the residuals are applied to check for the adequacy of our VECM model (i) the Portmanteau LB test, Godfrey LM test for autocorrelation,(ii)Autoregressive conditional Heteroskedastic LM test for ARCH effect and (ii) Jarque ó Bera test for Normality. The results are summarised in Tables 6 and 7.

The results of Table 6 show that the null hypothesis of no serial autocorrelation and conditional Heteroskedasticity will be accepted for portmanteau LB test and ARCH LM test since there p- values are greater tahn the significance values of 0.05 and 0.01 for the 5% and 1% significant levels. However, null hypothesis is rejected for Godfrey LM Test.

The Table 7 above test also shows that the three of the residuals are normal while the rest are not too far from normality, hence they can be regarded as adequate.

Cusum and Cusum – Sq Test for Stability: These two tests are applied to examine the stability of the long órun coefficient together with short run dynamic (Pearson and Pearson, 1997).CUSUM and CUSUM SQ test is propose by Brown, Durbin and Evans (1975). The test is applied to the residuals of all variables in the VECM model. If the plot of the CUSUM statistics stays within the critical bound of 95% level of significance represented by a pair of straight lines drawn at 95% level of significance the null hypothesis concerning all coefficients in the error correction model cannot be rejected. If any of the lines is crossed. The null hypothesis of coefficient

constancy at 95% level of significance will be rejected. A CUSUM-SQ test is based on the square recursive residuals; a similar procedure is used to carryout the test

Table 6: Results of VECM test for serial correlation and ARCH effect

Residuals	P ó values	Decisions
Portmanteau LB Test	0.6997	Accept H0
Godfrey LM Test	0.000	Reject H0
ARCH LM Test	0.1168	Accept H0

Table 7: Results of VECM Jaque ó Bera and Shapiro - Wilk test for Normality

Residuals	Jaque óBera test		Shapiro ó Wilk test	
	Pó Value	Pó Value	Pó Value	Decisions
U _{1t}	0.0734	0.1534	0.1534	Accept H0
U _{2t}	0.0120	0.0200	0.0200	Rejected H0
U _{3t}	0.2578	0.0875	0.0875	Accept H0
U _{4t}	0.0114	0.0123	0.0123	Reject H0
U _{5t}	0.0116	0.0110	0.0110	Reject H0
U _{6t}	0.1041	0.1632	0.1632	Accept H0

Figures 3-4 are a graphical representation of CUSUM and CUSUMSQ plots respectively which are applied to the error correction model selected by the adjusted R² criterion. CUSUM plots of the variables do not cross critical bounds which indicate that no evidence of any significant instability. However, in CUSUMSQ plot of Fig. 4 three plots slightly cross the critical bound indicating slight instability of these variables.

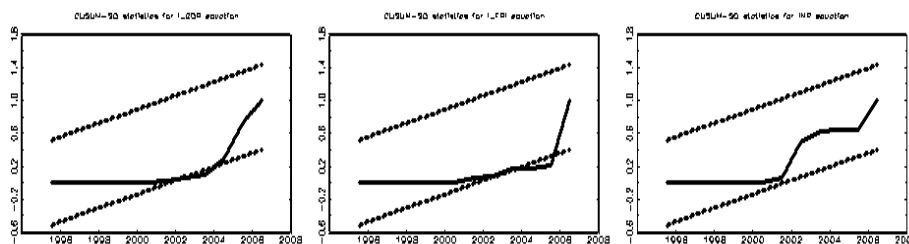


Fig. 3: Plots of Residuals CUSUM

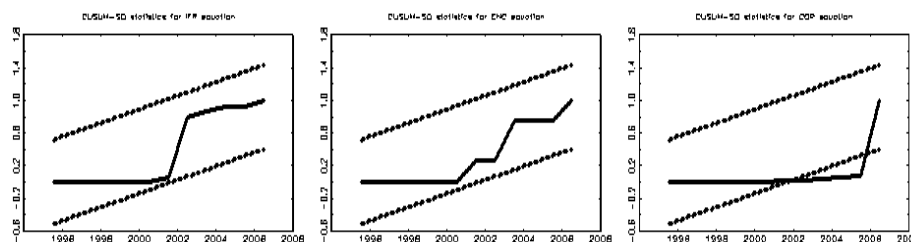


Fig.4: Plots of Residuals CUSUMSQ

Causality Analysis: Results for the analysis of causality are presented and the causality between the variables if any and the direction of the causality of the systems is determined using Granger Causality test. The results of the test are presented in Table 8. The results estimated show

that at 5% all the variables are Granger ó causal for GDP. However there is unidirectional causality between FPI and GDP, INR and GDP and, that is what happens between INF and FPI, and ENC and COP. But there is bi ódirection causality between FPI and INR

Table 8: Results of Granger- Causality Analysis

Null hypothesis	F- stat	póvalue	Decision rule
δ GDP does not Granger ó Cause FPI	3.9065	0.0147	reject null at 5%
δ FPI does not Granger ó Cause GDP	2.0172	0.1253	do not reject null
δ GDP does not Granger ó Cause INR	0.2556	0.8570	do not reject null
δ INR does not Granger ó Cause GDP	4.6699	0.0062	reject null
δ GDP does not Granger ó Cause IFR	0.3776	0.7696	do not reject null
δ IFR does not Granger ó Cause GDP	1.6534	0.1909	do not reject null
δ GDP does not Granger ó Cause ENC	1.100	0.3592	do not reject null
δ ENC does not Granger ó Cause GDP	1.2263	0.3114	do not reject null
δ GDP does not Granger ó Cause COP	0.6025	0.6169	do not reject null
δ COP does not Granger ó Cause GDP	0.8270	0.4859	do not reject null
δ FPI does not Granger ó Cause INR	4.5323	0.0075	reject null
δ INR does not Granger ó Cause FPI	5.6769	0.0022	reject null
δ FPI does not Granger ó Cause IFR	8.1395	0.0002	reject null
δ IFR does not Granger ó Cause FPI	0.9116	0.4431	do not reject null
δ FPI does not Granger ó Cause IFR	1.4361	0.2451	do not reject null
δ ENC does not Granger ó Cause FPI	0.0723	0.9723	do not reject null
δ FPI does not Granger ó Cause COP	0.1386	0.9364	do not reject null
δ COP does not Granger ó Cause FPI	0.3057	0.8211	do not reject null
δ IFR does not Granger ó Cause INR	2.6696	0.0591	do not reject null
δ INR does not Granger ó Cause IFR	2.9830	0.0414	reject null at 5%
δ ENC does not Granger ó Cause COP	5.4392	0.0029	reject null
δ COP does not Granger ó Cause ENC	2.0792	0.1167	do not reject null
δ ENC does not Granger ó Cause IFR	1.8644	0.1496	do not reject null
δ IFR does not Granger ó Cause ENC	1.2775	0.2938	do not reject null
δ ENC does not Granger ó Cause INR	0.2865	0.8349	do not reject null
δ INR does not Granger ó Cause ENC	0.0148	0.9975	do not reject null

CONCLUSION

In this study we have presented an analysis of the cointegration between the Foreign Direct Investment (FDI) and Growth Domestic Product

(GDP) with four other macroeconomic variables in Nigeria using the data obtained from central bank statistical Bulletin 2005 for the period of 1970 to 2004. The ADF Test, ADF ó GLS Test

and KPSS test shows that all the six variables are integrated of order one. VAR 3 and VECM 2 model are chosen base on Akaike criterion the johansen test show that VECM 2 has a cointegration relationship with rank of 1.

Further the Granger Causality Analysis shows a unidirectional causal relationship between GDP and FDI this is inline with other studies of Basu et al.(2003) and with four other macro economic variables. The results support the theoretical contention and give strong support to the hypothesis that FDI inflows have impact on GDP.

In conclusion, our econometric estimates of the impact of FDI on GDP model for Nigeria suggest that there exists a long run relationship between FDI, and GDP. Precisely, these findings suggest that the contribution of FDI to Nigerian's economic growth is about 0.873 and all other variables have long run relationship with positive contribution in the growth model except IFR which has negative impact as expected Uremadu (2008).

RECOMMENDATIONS

The following recommendations were made

- a) Having established the fact that foreign direct investment has positive impact on growth domestic product, government should strategize policies that would enhance foreign direct investment in Nigeria.
- b) Foreign Direct investment should be seen, not as an end in itself, but as a means of supporting other development initiatives such as poverty reduction or the Millennium Development Goals.
- c) Government should target the foreign investors which are most likely to respond, such as the national Diasporas.

REFERENCES

- Adeolu, B.A. (2007). FDI and Economic Growth: Evidence from Nigeria. AERC Research paper 165. *African Economic Research Consortium*, Nairobi, Kenya.
- Adelegan, J.O. (2000). Foreign direct investment and economic growth in Nigeria: A seemingly unrelated model. *African Review of Money, Finance and Banking*, Supplementary issue of "Savings and Development" 2000:5625. Milan, Italy.
- Akaike, H. (1974). *New look at the statistical model identification*, Institute of statistical mathematics, Minato-ku, Japan
- Akinlo, A. (2004). FDI and Economic Growth in Nigeria. An Empirical Investigation. *J. Policy Modeling* **26**: 627-639.
- Ariyo, A. (1998). Investment and Nigeria's economic growth. In *Investment in the Growth. Process Proceedings of Nigerian Economic Society Annual Conference 1998*: 3896415. Ibadan, Nigeria.
- Barnhill, T.M., Joutz, F.L. and Maxwell, W.F. (2000). Factors affecting the yields on non-investment grade bond indices: A cointegration analysis. *J. Empirical Fin.* **7**: 57686.
- Basu, P., Chakraborty, C. and Reagle, D. (2003). Liberalization, FDI, and Growth in Developing Countries: A Panel Cointegration Approach. *Econ. Inquiry*, **41**:510-16.
- Brown, R. L., Durbin, J., and Evans, J. M. (1975), "Techniques for Testing the Constancy of Regression Relationships over Time" *J. Royal Statist. Soc., Series B*, **39**: 1076113.
- Caves, R.E. (1996). *Multinational Enterprise and Economic Analysis*. 2nd edn. Cambridge: Cambridge University Press.
- CBN (2005). Statistical Bulletin. *Central Bank of Nigeria*, Volume 16 @ www.cenbank.org.
- Choe, J.I. (2003). Do foreign direct investment and gross domestic investment promote economic growth? *Rev. Dev. Econ.* **7**: 44-57.
- Chowdhury, A. and Mavrotas, G. (2003). FDI & growth: What causes what? Paper presented at the UNU/WIDER conference on Sharing Global Prosperity, September 2003, Helsinki, Finland.
- De Mello, L.R. (1999). Foreign direct investment-led growth: Evidence from time series and panel data. *Oxford Econ. Papers*, **51**: 133-151.
- Dickey, D.A., and Fuller, W.A. (1979). Distribution of the Estimators for Autoregressive Time Series with a Unit Root. *J. Am. Statist. Assoc.* **74**: 1057-1072.
- Edward, J.H and Quinn, B.G. (1979). The determination of the order of an autoregression. *J. Royal Statist. Soc. Series B* **41**: 190{195.

- Engle, R.F. (1982). Autoregressive conditional Heteroscedasticity with Estimates of the variance of united kingdoms inflations, *Econometrica*. **50**: 987 ó 1007.
- Engle, R.F. and Granger, C.W.J (1987). Co-integration and error correction: Representation, estimation and testing. *Econometrica* **55**: 251-276.
- Gideon, S. (1978). Estimating the dimension of a model. *The Annals Statis.* **6**: 461- 464.
- Granger, C.W.J.(1969) Investing Causal Relations by Econometric Models and cross- Spectral methods. *Econometrica* **37**: 424-438.
- Granger, C.W.J. (1981). Some properties of time series data and their use in econometric model specification, *J. Econometrics* **23**: 121-130.
- Johansen, S. (1991). Estimation and hypothesis testing of cointegrating vector in Gaussian vector autoregression models. *Econometrica* **59**: 1551ó1580.
- Lutkepohl, H. (1991). *Introduction to Multiple Time Series Analysis*, Berlin: Springer Verlag.
- Lutkepohl, H. (2005). *New Introduction to Multiple Time Series Analysis*, Berlin: Springer, Verlag.
- MacDonald, R. and Power, D. (1995). Stock prices, dividends and retention: Long-term relationships and short-term dynamics. *J. Empirical Finance* **2**: 135ó 151.
- Odozi, V.A. (1995). An Overview of Foreign Investment, 1960-65. *CBN Research Department Occasional Paper*, No. 11 (June)
- Oyinlola, O. (1995). External capital and economic development in Nigeria (1970ó 1991). *The Niger. J. Econ. Soc. Stud.* **37(2&3)**: 205ó222.
- Pesaran, M. H. and Pesaran, B. (1997). *Working with Micro_t 4.0: Interactive Econometric Analysis* Oxford University Press, Oxford.
- Phillips, P.C.B. and Perron, P. (1988). Testing for a Unit Root in Time Series Regression, *Biometrika*, **75**: 335ó346.
- Toda, H.Y. and Yamamoto, T. (1995). Statistical Inference in Vector Autoregressions with Possible Integrated Processes. *J. Econometrics* **66**: 225-250.
- Zhang, K.H. (2001). Does foreign direct investment promote economic growth? Evidence from East Asia and Latin America, *Contemp. Econ. Policy*, **19**: 175-185.