

# Foreign Direct Investment, Non-Oil Exports, and Economic Growth in Nigeria: A Causality Analysis

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## **ABSTRACT**

The study examines the applicability of the export-led growth (ELG) hypothesis using empirical evidence from Nigeria. The bulk of FDI inflow into the country goes to the oil sector of the economy. But FDI from the perspective of *efficiency-seeking* indicates that foreign capital always aims at taking advantage of cost-efficient production condition. There is the general belief that this motive is predominant in sectors where products are produced mainly for regional and global markets and competition is mostly based on price and not on quality differentiation. In Nigeria, the role of FDI in the non oil exports – growth nexus has hitherto been under-researched. This role therefore is the major focus of this study. A causality analysis of the relevant variables was undertaken in order to verify the relevance of the ELG hypothesis in the Nigerian economy. Empirical evidence from available data failed to support the export-led growth hypothesis in Nigeria. Besides, the dynamic interaction among FDI, non-oil exports, and growth of the Nigerian economy was also investigated using the concept of variance decomposition and impulse response analysis. The result of the variance decomposition supports an earlier result obtained from the causality analysis which revealed that, a unidirectional causality runs from FDI to non-oil exports. Responses of the three variables to one standard deviation innovations were on the average, found to be dormant in the early stages of the out-of-sample forecast period but all demonstrated more pronounced responses after about 7 years into the forecast period.

## 1.0 INTRODUCTION

Nigeria has achieved some appreciable economic growth in recent times. A number of explanations of this observed trend have been attempted in different academic papers. Non-oil exports performance has also improved considerably during this period. Several factors appear to have contributed to this phenomenon including a rapid improvement in trade liberalization, concerted efforts to diversify the productive base of the economy, and a substantial increase in foreign direct investment (FDI) inflows into the country. Arguably, FDI is one of the most important strategies for the promotion of economic growth and development in poor developing countries. FDI can serve as an engine of growth and development for developing countries by increasing the opportunity for their integration into global financial and capital flows, expand employment and exports base, generate technological capability-building and efficiency spillovers to local firms, as well as establish investment arrangements that increase the potential of host countries for economic growth.

Expectedly, the role of exports in economic performance of developing countries has become one of the more intensively studied topics in recent years. The major impetus for most studies on this relationship is the export-led growth (ELG) hypothesis which interestingly represents a dominant explanation in this context. The ELG hypothesis states that the growth of exports has a favourable impact on economic growth. However, the empirical evidence on the causal relationship between exports and growth is mixed. In particular, available time series studies fail to provide uniform support for the ELG hypothesis while most cross-sectional studies provide empirical evidence in support of the hypothesis. The liberalization process in developing countries has increased not only trade but also FDI flows. Thus, FDI has also become an important link in the export-growth relationship.

Overall, empirical evidence in the last few decades indicates that FDI flows have been growing at a pace far exceeding the volume of international trade. Between 1975 and 1995, the aggregate stock of FDI rose from 4.5% to 9.7% of world GDP, with sales of foreign affiliates of multinational enterprises substantially exceeding the value of world exports (Barrell and Pain, 1997). The United Nations Conference on Trade and Development, UNCTAD (2007) reports that FDI flow to Africa has increased from \$9.68 billion in 2000 to \$1.3 trillion in 2006. The UNCTAD World Investment Report 2006 shows that FDI inflow to West Africa is mainly dominated by inflow to Nigeria, who received 70% of the sub-regional total and 11% of Africa's total. Out of this Nigeria's oil sector alone receive 90% of the FDI inflow.

The performance of the Nigerian non-oil export sector, as pointed out earlier, has however been relatively impressive in recent times. For example, the International Monetary Fund (IMF) 2008 is of the view that the robust non-oil sector growth in the 2007 fiscal year had offset the drag from a decline in oil production in the Niger Delta, thus boosting growth in the Nigerian economy.

Aggregate output growth measured by the gross domestic product (GDP), according to the Central Bank of Nigeria (CBN) 2007, economic report for third quarter of 2007, was estimated at 6.05 per cent, compared with 5.73 per cent in the second quarter. The growth was driven by the non-oil sector which was estimated at 9.47 per cent. This growth was driven mainly by major agricultural activities such as yam, Irish and sweet potatoes, groundnuts and maize.

The favourable economic environment has made some countries in SSA increasingly attractive as destinations for private capital inflows. Net private capital inflows reached record levels in 2007, led by strong FDI inflows. However, the bulk of FDI is still focused on a few countries and targeted mainly at extractive industries, particularly the petroleum sector, based on evidence from cross-

border mergers-and-acquisition related inflows, an important fraction of gross FDI inflows. But, deposit outflows from some oil exporters notably Libya, Nigeria, and Russia displayed some of the highest correlations, while for others including Saudi Arabia and other Middle Eastern oil exporters, the correlations were only modest. Libya, Nigeria, and Russia also accounted for one-half of all deposit outflows from oil-exporting countries, and in each of these countries deposit outflows accounted for one-half or more of total gross capital outflows. These huge capital outflows are linked mainly to extractive FDI and calls to question the ability of FDI to drive growth effectively in these countries.

It is noteworthy however, that despite the observed increasing inflows of FDI, there has not been any satisfactory attempt to assess its contribution to Nigeria's (non-oil) export performance- a major channel through which FDI affects economic growth. This call for an empirical investigation and the questions here now are, can we find evidence to support the (non-oil) export led growth in Nigeria? What vital role does FDI play in the ELG relationship if it exists? Are there any causal relationships or what are the dynamic interactions among (non-oil) exports, FDI, and economic growth in Nigeria? In this study, we explore an econometric analysis of these issues using appropriate techniques.

The rest of the paper is divided into sections as follows: section two comprises a brief survey of related literature and it addresses mainly the theoretical and empirical issues. Section three considers methodology and data while the fourth section is devoted to the empirical findings or results. Section five is the last section and is made of summary and conclusions.

## **2.0 LITERATURE REVIEW**

We begin this section by reviewing the export-led growth hypothesis essentially to motivate an empirical exercise of this nature. The export-led growth hypothesis as stated earlier, postulates that exports are a main determinant of overall economic growth. The theoretical rationale for this hypothesis hinges on a number of arguments which include the following: first, that the export sector may generate positive externalities on non-export sectors through more efficient management styles and improved production techniques (Feder, 1982). Second export expansion will increase productivity by offering potential for scale economies (Helpman and Krugman, 1985; Krugman 1997). Third, exports are likely to alleviate foreign exchange constraints and can thereby provide greater access to international markets (Esfahani, 1991). These arguments have recently been extended by the literature on "endogenous" growth theory which emphasizes the role of exports on long-run growth via a higher rate of technological innovation and dynamic learning from abroad (Lucas, 1988; Romer, 1986, 1989; Grossman and Helpman, 1991, 1995; Edwards, 1992; Alisana and Rodrick, 1999).

Although the ELG hypothesis remains quite popular, the related empirical evidence based on time series studies is mixed. Surprisingly, most literatures based on cross-section studies support a positive link between exports and growth. However, such results obtained by cross-country studies must be treated with great caution as they are subject to extreme limitations. These limitations are clearly outlined in Giles and Williams, (2000) to include the following: first, the implicit assumption of a common economic structure and similar production technology across different countries appears an over-simplification of reality. Again, cross-country differences in technology presumably affect both the international pattern of specialization and trade, and the rate of technological progress and growth. Second, the economic growth of a country is influenced by a host of domestic policies such as monetary, fiscal and external policies, which are not taken into account. Third, cross-country

regressions take positive associations as evidence of causation and provide little insight into the way exports affect growth. To address these identified potential limitations with cross-sectional studies, a number of time-series studies have been undertaken.

There are a number of ways through which Trade flows and FDI can be linked. Goldberg and Klein, (1998) asserted that FDI may encourage export promotion, import substitution, or greater trade in intermediate inputs which often exist between parent and affiliate producers. The orientation of most investments by multinational firms is towards exports and this may most likely serve as a catalyst for the integration of the FDI host economy to a global production network in sectors in which it may formerly have had no industrial experience (OECD, 1998). Rodriguez Clare (1996); Calderón, Mortimore and Peres (1996) argue that the very nature of the activities of multinational enterprises in Mexico could encourage the expansion of its industrial exports. These studies clearly indicate that FDI could be associated with export trade in goods, and the host country may enjoy an FDI led export growth. Goldberg and Klein (1998, 1999) do not find evidence to support a significant link between FDI and aggregate exports in Latin America. According to them, the trade-promoting effects of FDI appear to be weak or insignificant with regard to Latin American trade with the United States and Japan. Their results also failed to find a systematic linkage between sectoral trade and FDI in Latin America.

The generation of productivity spillovers is one possible channel through which FDI can affect growth. Some earlier studies found evidence that FDI has led to significant positive spillover effects on the labour productivity of domestic firms and on the rate of growth of domestic productivity in Mexico [Blömstrom and Persson (1983), Blömstrom (1986), Blomström and Wolf, (1994)]. However, Kokko, Tansini and Zejan (1996) cautioned in the case of Mexico and Uruguay, that spillovers are difficult to identify in industries where foreign affiliates have much higher productivity levels than local firms. De Gregorio (2003) contributes to the debate on the importance of FDI by noting that FDI may allow a country to bring in technologies and knowledge that are not readily available to domestic investors, and in this way increases productivity growth throughout the economy. Dolan and Tomlin (1980) found that FDI flows were positively associated with growth of per capita income but that the stock of FDI had a negative effect on growth. This result is supported by Saltz (1992) who confirms a negative stock effect for a sample of 75 developing countries for the period 1970-80. Balasubramanyam, Salisu, and Sapsford (1996) analyses how FDI affects economic growth in developing economies. Using cross-sectional data and OLS regressions, they found that FDI has a positive effect on economic growth in host countries with an export promoting strategy but not in countries using an import substitution strategy.

A number of studies on the FDI-growth nexus in Nigeria exist in the literature. For example, Otepola (2002), in a work on FDI and economic growth in Nigeria reported a low level of existing human capital suggesting that the human capital (labour) available in Nigeria is not FDI inducing. Akinlo (2004) noted that export, labour, and human capital are positively related to economic growth in Nigeria. Ayanwale and Bamire (2001) assess the influence of FDI on firm level productivity in Nigeria and report a positive spillover of foreign firms on domestic firm's productivity. Oyinlola (1995) conceptualized foreign capital to include foreign loans, direct foreign investments and export earnings. Using Chenery and Stout's two-gap model (Chenery and Stout, 1966), he concluded that FDI has a negative effect on economic development in Nigeria. 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. Aluko (1961), Brown (1962) and Obinna (1983) report positive linkages between FDI and economic growth in Nigeria.

Edozien (1968) discusses the linkage effects of FDI on the Nigerian economy and submits that these have not been considerable and that the broad linkage effects were lower than the Chenery–Watanabe average (Chenery and Watanabe, 1958). Oseghale and Amonkhienan (1987) found that FDI is positively associated with GDP, concluding that greater inflow of FDI will spell a better economic performance for the country. Ayanwale (2007) investigated the empirical relationship between non-extractive FDI and economic growth in Nigeria. Using OLS estimates, he found that FDI has a positive link with economic growth but cautioned that the overall effect of FDI on economic growth may not be significant. Herzer et al (2006) using a bivariate VAR modeling technique, found evidence of a positive FDI-led growth for Nigeria, Sri Lanka, Tunisia, and Egypt; and based on weak exogeneity tests, a long-run causality between FDI and economic growth running in both directions was found for the same set of countries. A slight difference from this result is observed in Okodua (2009) who examined the sustainability of the FDI-growth relationship in Nigeria. Using the Johansen cointegration framework and a multivariate VAR within a vector error correction model, found evidence of a long-run equilibrium relationship between economic growth and FDI inflows. The study also revealed a unidirectional causality from FDI to economic growth.

### 3.0 METHODOLOGY AND DATA

The analytical procedure adopted in this study is discussed below and these include: the empirical model, the concept of granger causality within a cointegration framework, Vector Error-Correction Modeling (VECM) and Exogeneity, Impulse response functions (IRFs), as well as Variance Decompositions (VDCs) and Relative Exogeneity. We then proceed to discuss empirical results.

#### 3.1 The Empirical Model

We proceed to specify the baseline empirical model which captures the hypothesized relationship among the core variables under investigation. In doing this, the endogenous growth theory is considered a very useful guide. This theory of course emphasizes the role of exports on long-run growth via a higher rate of technological innovation and dynamic learning from abroad (Lucas, 1988; Romer, 1986). The specified model is provided in equation (1) below.

$$Growth = f(FDI, NOX) \quad (1)$$

Where *Growth* represents economic growth measured by the growth rate of real Gross Domestic Output (GDP), FDI is Foreign Direct Investment inflows, and *NOX* is Non-Oil Exports. Data on these variables from 1980 to 2007 are sourced from the Central Bank of Nigeria (CBN) Statistical Bulletin (2007). Equation (1) may only be estimated in its econometric form which is stated as follows:

$$Growth_t = \delta_0 + \delta_1 FDI_t + \delta_2 NOX_t + v_t \quad (2)$$

$\delta_0$  denotes the intercept term,  $\delta_i$  are slope coefficients representing parameters to be estimated,  $v_t$  is the disturbance term assumed to be purely random, and the subscripts,  $t$  are for the dating of

variables in time periods. On a priori grounds, the various theoretical expectations are:  $\delta_0, \delta_1, \text{ and } \delta_2 > 0$

The long-run relationship among variables in equation (2) is estimated using the Johansen cointegration technique. This technique is based on the vector autoregressive (VAR) models. One major difference between the Johansen approach and the Engle and Granger two step procedure is that “Engle--Granger did not permit the testing of hypotheses on the cointegrating relationships themselves, but the Johansen setup does permit the testing of hypotheses about the equilibrium relationships between the variables” (Brooks, 2008: 354).

Given that a set of  $g$  variables ( $g = 3$  in this case) are under consideration, the starting point here is an examination of the time series properties of all three variables included in equation (2). This is done by conducting a unit root test of the relevant variables where the order of integration of each series is determined. All  $I(1)$  series are then regarded as first differenced stationary and the variables are said to be cointegrated if a linear combination produces  $I(0)$  result. The existence of a cointegrating relationship means that a long-run equilibrium relationship exists among the cointegrating variables. Cointegration presupposes causality in at least one direction, and this may be determined by employing a vector error correction model (VECM). Beginning with a simple VAR model with  $k$  lags such as in equation (3) below:

$$y_t = \beta_1 y_{t-1} + \beta_2 y_{t-2} + \dots + \beta_k y_{t-k} + u_t \quad (3)$$

A typical VECM in its simplest form will appear as follows:

$$\Delta y_t = \Pi y_{t-k} + \Gamma_1 \Delta y_{t-1} + \Gamma_2 \Delta y_{t-2} + \dots + \Gamma_{k-1} \Delta y_{t-(k-1)} + u_t \quad (4)$$

where:  $\Pi = \left( \sum_{i=1}^k \beta_i \right) - I_g$  and  $\Gamma_i = \left( \sum_{j=1}^i \beta_j \right) - I_g$

The Johansen test is very sensitive to the lag length employed in the VECM, including too few lags will not remove all of the autocorrelation, thus biasing the results, and including too many lags will increase the coefficient standard errors since the additional parameters will simply use up available degrees of freedom (Brooks, 2008). So, it is useful to attempt to select the lag length optimally. The VECM is a case of unrestricted VAR, thus it is required that the same number of lags of all of the variables is used in all equations. Most econometric software have facility for a multivariate information criterion which allows for comparison across information criteria for use in this regard. In order to determine the appropriate lag lengths, we employed the multivariate generalization of Akaike’s information criterion (*AIC*).

The Johansen test centres around an examination of the  $\Pi$  matrix.  $\Pi$  can be interpreted as a long-run coefficient matrix, since in equilibrium, all the  $\Delta y_{t-i}$  will be zero, and setting the error terms,  $u_t$ , to their expected value of zero will leave  $\Pi y_{t-k} = 0$ . The test for cointegration between the  $y_s$  is calculated by looking at the rank of the  $\Pi$  matrix via its eigenvalues. For the Johansen procedure, there are two test statistics for the number of cointegrating vectors: the trace ( $\lambda_{trace}$ ) and the maximum value statistics, ( $\lambda_{maximum}$ ). In the trace test, the null hypothesis is that the number of cointegrating vectors is less than or equal to  $r$ , where  $r = 0$  to 2. In each case the null hypothesis is tested against the general alternative. The maximum eigenvalue test is similar, except that the

alternative hypothesis is explicit. The null hypothesis  $r=0$  is tested against the alternative that  $r=1$ ,  $r=1$  against  $r=2$ .

### 3.2 Cointegration and Granger causality

Two or more variables are said to be cointegrated, meaning that they exhibit long-run equilibrium relationship(s), if they share common trend(s). The pioneering work by Engle and Granger (1987), Hendry (1986) and Granger (1986) on the cointegration technique identified the existence of a cointegrating relationship as the basis for causality. Causality here, of course implies the presence of feedback from one variable to another. According to this technique, if two variables are cointegrated, causality must exist in at least one direction, (Granger, 1988, Miller and Russek, 1990); and may be detected through the vector error-correction model derived from the longrun cointegrating vectors. Testing for Granger-causality, requires checking whether specific coefficients are zero, hence, standard tests for zero restrictions on VAR coefficients are often employed ( $\chi^2$ - or  $F$ -tests based on the Wald principle are typically thought of in this context).

One major drawback with cointegration analysis is that these tests for cointegration turn each series stationary mechanically by differencing the variables and consequently eliminating the long-run information embodied in the original level form of the variables. Fortunately, the error-correction model (ECM) derived from the cointegrating equations by including the lagged error-correction term reintroduces, in a statistically acceptable way, the long-run information lost through differencing. The error-correction term stands for the short-run adjustment to long-run equilibrium trends.

### 3.3 Vector Error-Correction Modeling (VECM) and Exogeneity

A corresponding error correction representation always exists in all cases where a number of variables (for example,  $X_t$  and  $Y_t$ ) are found to be cointegrated (Engle and Granger, 1987). The implication here is that changes in the dependent variable are a function of disequilibrium in the cointegrating relationship as captured by the error correction term as well as changes in other explanatory variable(s). In this case, either  $DX_t$  or  $DY_t$  or both must be caused by  $e_{t-1}$  (the equilibrium error) that is itself a function of  $x_{t-1}$  and  $y_{t-1}$ .

The Error Correction Model (ECM) opens an additional channel for Granger causality (ignored by standard Granger and Sims tests) to emerge through the error-correction term. As clearly explained in Erjavec and Cota (2003), we rely on the statistical significance of the  $F$ -tests which is applicable to the joint significance of the sum of the lags of each explanatory variable and/or the  $t$ -test of the lagged error-correction term(s) so as to indicate Granger causality (or endogeneity of the dependent variable). Of course, the non-significance of both the  $t$ -test(s) as well as the  $F$ -tests in the VECM will imply econometric exogeneity of the dependent variable. The  $F$ -tests of the 'differenced' explanatory variables give us an indication of the 'short-term' causal effects, meaning, strict exogeneity of the variables. Also, the significance of the lagged error-correction term(s) will indicate the 'long-term' causal relationship.

The coefficient of the lagged error-correction term, however, is a short-term adjustment coefficient and represents the proportion by which the long-term disequilibrium (or imbalance) in the dependent variable is being corrected in each short period. The lagged error-correction term contains the long-run information, since it is derived from the long-term cointegration relationship(s). Weak exogeneity of the variable refers to ECM-dependence, i.e. dependence upon stochastic trend.

### **3.4 Impulse response functions (IRFs)**

The IRFs are obtained from the MA representation of the original VAR model. The IRFs are the dynamic response of each endogenous variable to a one-period standard deviation shock to the system. Impulse responses trace out the responsiveness of the dependent variables in the VAR to shocks to each of the variables. So, for each variable from each equation separately, a unit shock is applied to the error, and the effects upon the VAR system over time are noted (Brooks, 2008).

### **3.5 Variance Decompositions (VDCs) and Relative Exogeneity**

Variance decompositions offer a slightly different method for examining VAR system dynamics. They give the proportion of the movements in the dependent variables that are due to their 'own' shocks, versus shocks to the other variables. The VECM, F- and t- tests may be interpreted as within-sample causality tests. They can indicate only the Granger causality of the dependent variable within the sample period. They provide little evidence on the dynamic properties of the system, the relative strength of the Granger-causal chain or a degree of Exogeneity among the variables. On the other hand, the variance decompositions (VDCs), by partitioning the variance of the forecast error of a certain variable into the proportions attributable to innovations (or shocks) in each variable in the system including its own, can provide an indication of these relativities. VDCs may be termed as out-of-sample causality tests (Bessler and Kling 1985). The variable that is optimally forecast from its own lagged values will have all its forecast error variance explained by its own disturbances, (Sims, 1982).

A very important consideration in the calculation of impulse responses and variance decompositions is the ordering of the variables. In practice, the error terms are likely to be correlated across VAR equations to some extent and failure to assume this would lead to a misrepresentation of the system dynamics. The usual approach in this case is to generate *orthogonalised impulse responses* while considering the sensitivity of results at every stage.

## **4.0 EMPIRICAL RESULTS**

The empirical results obtained from this study are presented and discussed below. We first examine the integration order of each of the time series included in the model. As a necessary but not sufficient condition for cointegration, each of the variables must be integrated of the same order, where the order of integration must be greater than zero. To achieve this, we apply two set of unit root tests for stationarity and these include the Augmented Dickey-Fuller (ADF) and the Phillips-Perron (PP) tests. (see: Dickey and Fuller, 1979; Phillips and Perron, 1988). These results are presented in table 1 below.

**Table 1: Unit Root Test for Stationarity**

ADF UNIT ROOT TEST					
Variable		ADF value (constant included)		ADF value (constant and linear trend included)	
		Level	First differenced	Level	First differenced
Growth		-3.6366** (0)	-6.6688* (0)	-3.9524** (0)	-6.6200* (0)
NOX		6.1589* (6)	2.6827*** (6)	4.3551** (6)	0.9468 (6)
FDI		4.7447** (2)	-0.2012 (2)	2.8383 (2)	-1.1713 (2)
Critical values	1%	-3.7379	-3.7529	-4.3943	-4.416
	5%	-2.9919	-2.9980	-3.6122	-3.6220
	10%	-2.6355	-2.6388	-3.2431	-3.2486
PP UNIT ROOT TEST					
Variable		PP value (constant included)		PP value (constant and linear trend included)	
		Level	First differenced	Level	First differenced
Growth		-3.4994**[7]	-9.2021*[12]	-3.8488**[6]	-9.5596*[13]
NOX		2.2923 [1]	-4.6006* [2]	-0.2312 [0]	-5.7301* [2]
FDI		-1.9814 [1]	-6.0215* [2]	-3.0217 [1]	-6.4026* [3]
Critical values	1%	-3.7115	-3.7241	-4.3561	-4.3743
	5%	-2.9810	-2.9862	-3.5950	-3.6032
	10%	-2.6299	-2.6326	-3.2335	-3.2380

Notes: \* indicates significant at one percent or a rejection of the null of no unit root at the one percent level  
 \*\* indicates significant at five percent or a rejection of the null of no unit root at the five percent level  
 \*\*\* indicates significant at ten percent or a rejection of the null of no unit root at the ten percent level  
 Optimal lags based on Schwartz information criterion are in curly brackets and optimal Newey-West bandwidths are in square brackets  
 The critical values are from Osterwald-Lenum, (1992)

The results of the unit root tests for stationarity of individual time series are reported in table 1 above. The PP tests are non-parametric unit root tests that are modified so that serial correlation does not affect their asymptotic distribution. PP tests reveal that all variables are integrated of order one with and without linear trends, and with or without intercept terms. An inspection of the figures reveals that each series is first difference stationary at the one percent level using the PP test. What this means is that we cannot reject the presence of a unit root for any of the variables under the PP tests. However, the ADF test result is not as impressive, as only the growth variable passed the differenced stationarity test at the one percent level. We therefore rely on the PP test result as a basis for a cointegration test among all stationary series of the same order.

#### 4.1 Testing for Co-integration (the Johansen approach)

Here, we investigate for the existence of any unique equilibrium relationship(s) among the stationary variables of the same order of integration. The Johansen methodology is a VAR based approach. The results based on VARs are generally found to be sensitive to the lag length used and this compelled us to devote a considerable time to the selection of the lag structure. Variables lag lengths were chosen by minimizing the Akaike information criterion. The selected lag length(s) are thus those that reduce autocorrelation in the model. The results are presented in table 2 below.

**Table 2: Result of the Co-integration (Johansen Technique)**

TRACE TEST				
Hypothesized No. of CE(s)	Eigenvalue	Trace Statistic	5 Percent Critical Value	1 Percent Critical Value
$r = 0^{**}$	0.796227	59.18946	29.68	35.65
$r \leq 1^{**}$	0.569539	21.01154	15.41	20.04
$r \leq 2$	0.032058	0.781994	3.76	6.65
MAXIMUM EIGENVALUE TEST				
Hypothesized No. of CE(s)	Eigenvalue	Max-Eigen Statistic	5 Percent Critical Value	1 Percent Critical Value
$r = 0^{**}$	0.796227	38.17792	20.97	25.52
$r \leq 1^{**}$	0.569539	20.22955	14.07	18.63
$r \leq 2$	0.032058	0.781994	3.76	6.65
Cointegrating coefficient normalized on Growth				
Growth = 0.00258FDI (11.68)			(5)	
Cointegrating coefficient normalized on NOX				
NOX = 0.325128FDI (12.66)			(6)	
Trace test indicates 2 cointegrating equation(s) at both 5% and 1% levels Max-eigenvalue test indicates 2 cointegrating equation(s) at both 5% and 1% levels *(**) denotes rejection of the hypothesis at the 5%(1%) level Critical values are from Osterwald-Lenum, (1992) t-values are reported in parenthesis below the normalized coefficients				

Cointegration test includes assumptions that allowed for linear deterministic trend in data, no intercept or trend in cointegrating equation, and test VAR. both the trace and maximum eigenvalue test results reveal the existence of two unique cointegrating vectors between test variables. These assumptions are in any case consistent with the level that minimizes the Akaike information criterion for the selection of the optimal lag interval of (1,1). Looking at the results, the normalized cointegrating equation (5) reveals that in the long-run, foreign direct investment affects economic growth positively in Nigeria. This positive effect of FDI on growth outcome, though significant when judged by the t-statistic, is unimpressively low as only about one percent change in economic growth will arise from a hundred percent change in FDI inflows into the country within the context of the long-run horizon. In a similar vein, an examination of the result in the normalized cointegrating equation (6) shows that FDI inflows in Nigeria contribute positively to non-oil exports in the long-run. Interestingly, this result is a more impressive than that of the growth equation. As can be seen, a one hundred percent change in FDI leads to about thirty three percent change in NOX in the same direction, again over the long-run horizon. This of course is highly significant judging from the t-statistic. The result in the growth equation supports the findings in Aluko (1961), Brown (1962), Obinna (1983), Oseghale and Amonkhienan (1987), Akinlo (2004) and Ayanwale (2007). But as earlier pointed out, the existence of cointegration clearly suggests, in a temporal sense, the existence of a causal relationship in at least one direction between or among the cointegrating

variables. Fortunately, the information on causation is embodied in the vector error correction model (VECM). So, in what follows, we proceed to examine the VECM.

#### 4.2 Vector Error Correction Model

All variables in the cointegrating equation are assumed endogenous in a VAR structure. The VECM extends this by making use of differenced data and lagged differenced data of the chosen variables in a VAR structure. An essential element of the VECM is the error correction term or factor. The coefficient of the error correction term is theoretically expected to be negatively signed and have a value between zero and one. This is to ensure that equilibrium error correction within the system over time is at least meaningful. Besides, the VECM contains vital information on causal relationships and the dynamic interactions among the cointegrating variables. This vital information is made clearer through variance decomposition and impulse response analysis. Variance decompositions in the true sense may be regarded as out-of-sample causality tests (Bessler and Kling 1985). The results of the temporal causality based on VECM are presented in the table below.

**Table 3: Temporal causality based on VECM**

Dependent variable	$\Delta$ Growth	$\Delta$ NOX	$\Delta$ FDI	ECT <sub>t-1</sub>
	F-statistics (P-Values)			t-statistics
$\Delta$ Growth	-	0.8951	0.3836	-0.11202
$\Delta$ NOX	0.7402	-	0.0000*	0.86351
$\Delta$ FDI	0.9681	0.7803	-	-5.42631*

Note: All variables are in first differences (denoted by  $\Delta$ ) except the lagged error correction term (ect<sub>t-1</sub>)  
 The ect<sub>t-1</sub> were generated from the Johansen co-integration test  
 \* denotes significant at 1 percent level

The results of the temporal causality based on VECM are reported in table 3 above. Diagnostic tests were conducted for various orders of serial correlation, normality and heteroscedasticity. The results (not reported here in order to conserve space, but may be made available on request), were in general considered satisfactory. The results shown in table 3 are clearly indicative of the presence of a unidirectional short-run causality running from FDI to non-oil exports. All other combinations failed to demonstrate evidence of causal relationship in any direction. The error correction term for changes in FDI is highly significant even at the one percent level. What this means is that a long-run causality running from growth and non-oil exports to FDI also exist in Nigeria. A major implication of this result is that the export-led growth hypothesis is not supported by evidence from Nigeria.

#### 4.3 Variance Decompositions based on VECM Results

Variance Decompositions is very sensitive to the ordering of variables. Thus two orderings have been applied and they are the exact opposite of each other. At each stage, the sensitivity of the result is considered. We employ a ten year forecasting (out of sample forecast) horizon and observe the relevance of the variable ordering over time. The results are presented below in table 4.

**Table 4: Decomposition of Variance**

Forecast Year	Relative Variance In:	Percentage of Forecast Variance Explained by innovations in					
		$\Delta$ GROWTH		$\Delta$ NOX		$\Delta$ FDI	
		I	II	I	II	I	II
1	$\Delta$ Growth	100.00	71.95	0.00	13.72	0.00	14.33
4		94.37	60.18	2.85	16.96	2.76	22.86
7		25.57	15.71	35.07	6.94	39.35	77.34
10		14.77	2.66	13.96	11.23	71.27	86.11
1	$\Delta$ NOX	0.41	0.00	99.58	63.13	0.00	14.33
4		1.82	0.15	90.29	53.39	7.88	46.46
7		16.70	0.37	21.51	4.80	61.79	94.83
10		19.99	0.14	24.84	2.92	55.17	96.94
1	$\Delta$ FDI	14.33	0.00	40.06	0.00	45.61	100.00
4		20.46	0.14	22.28	4.44	57.26	95.42
7		21.96	0.96	32.30	1.40	45.74	97.64
10		17.68	4.95	26.38	11.03	55.94	84.02

Note: Ordering – (I) GROWTH, NOX, FDI  
(II) FDI, NOX, GROWTH

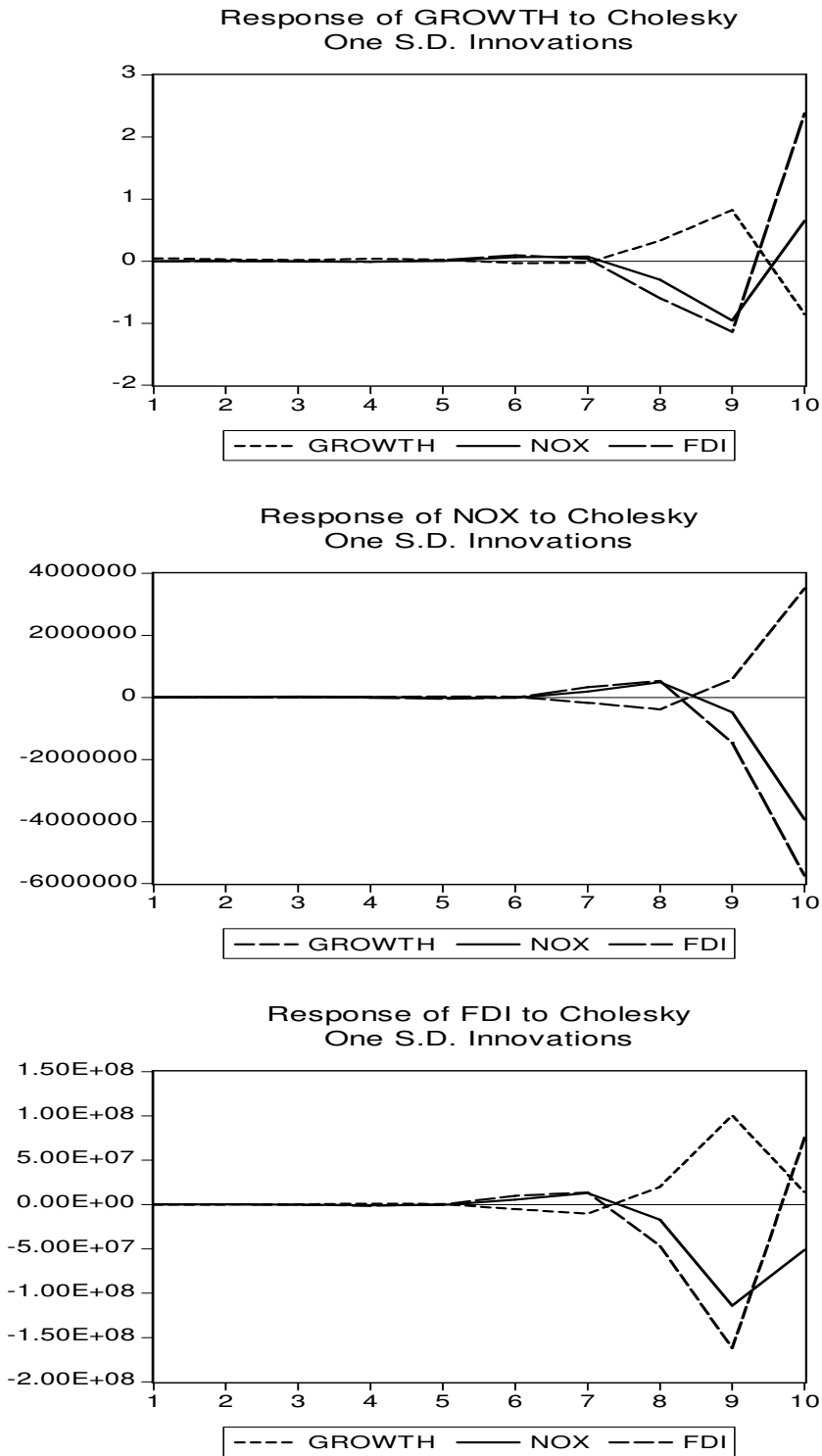
As earlier emphasized, the ordering of variables is of immense importance in decomposition of variance. The relevance of ordering can be seen clearly between the values under orderings I and II over the same forecasting horizon reported in table 4 above. Various interesting features of the results are noted. For example, shocks to the variable *growth*, in forecast year 1 accounted for 100% and 71.95% of the variations in *growth* under orderings I and II respectively. During the same forecasting period, shocks to *NOX* and *FDI* accounted for 0% of the variations in *growth* using ordering I but accounted for 13.72% and 14.33% of the variations in *growth* under ordering II. Similar explanations hold for the variations in *growth* in the other forecast periods.

Again, shocks to *growth* accounted for 0.41% and 0.00% of the variations in *NOX* using orderings I and II respectively during the forecast year one. Shocks to *NOX* accounted for 99.58% and 63.13% of the variations in *NOX* using orderings I and II respectively during the forecast year one. *FDI*, after the first three years explains about 47% of the variations in *NOX* and 95.42% due to its own shocks. This result further supports the fact that a unidirectional causality runs from *FDI* to *NOX*.

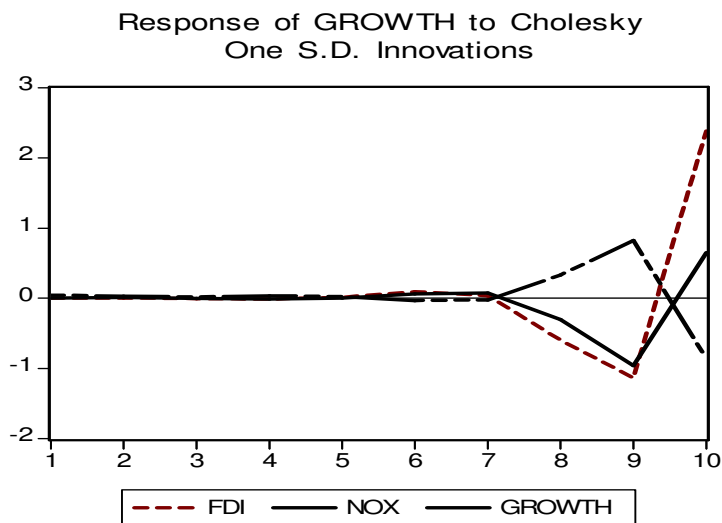
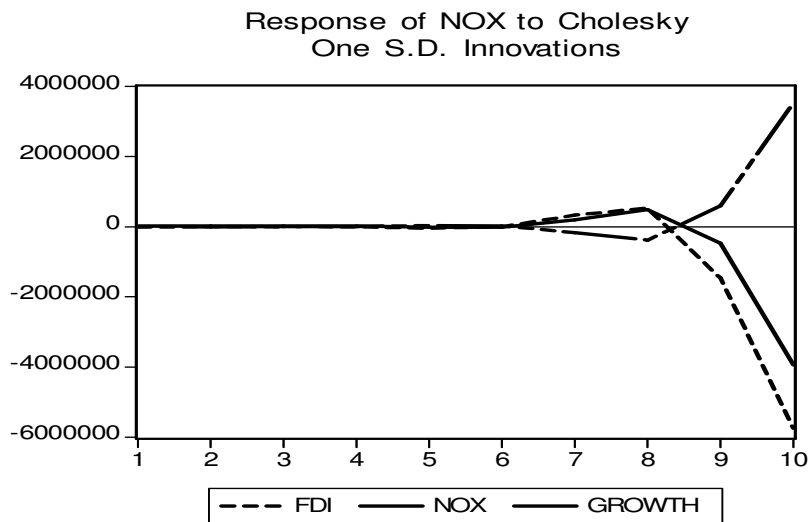
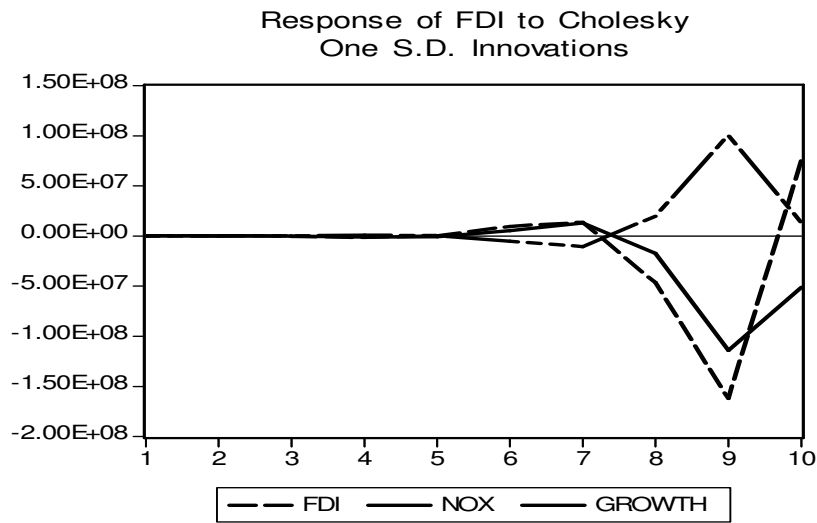
#### 4.4 Impulse Response Analysis

We again recall here that ordering of variables has an effect on the impulse response functions and in the absence of any theory compelling an obvious ordering for the series, the logical thing to do is to undertake some sensitivity analysis. In what follows therefore, we present the impulse response functions in the figures below.

**Figure 2: Impulse Response Function (Ordering I – Growth, NOX, FDI)**



**Figure 2: Impulse Response Function (Ordering II - FDI, NOX, GROWTH)**



Figures 1 and 2 reveal the effects of one standard deviation shocks on each of the variables over time. An interesting observation in these results is that the impulse responses do not appear to be very sensitive to the ordering of variables. Another striking feature of these results is that in both orderings, shocks appear to die down at early stages only to become very pronounced later on. A total of 9 impulse responses could be calculated since there are 3 variables in the system.

In figure 1, considering the signs of the responses, innovations to unexpected movements in FDI produced little or no response from the three variables under consideration up to the seventh forecast year. Beyond this period, a one standard deviation shock to FDI attracted significant negative response from NOX and FDI itself. The response from growth was however positive during the same forecast period. Similar explanations are applicable to the others in both figures.

## 5.0 CONCLUSIONS

The study examined the applicability of the export-led growth (ELG) hypothesis using evidence from Nigeria. The role of FDI in the non oil exports – growth nexus was also examined. A causality analysis of the relevant variable was undertaken in order to verify the relevance of the ELG hypothesis in the Nigerian economy. Empirical evidence from available data failed to support the export-led growth hypothesis in Nigeria. Besides, the dynamic interaction among FDI, non-oil exports, and growth of the Nigerian economy was also investigated using the concept of variance decomposition and impulse response analysis. The result of the variance decomposition supports an earlier result obtained from the causality analysis which revealed that, a unidirectional causality runs from FDI to *NOX*. Responses of the three variables to one standard deviation innovations were on the average, found to be dormant in the early stages of the out-of-sample forecast period but all demonstrated pronounced responses after about 7 years into the forecast period.

It is therefore important to remark here that policy shocks to FDI, non-oil exports, and economic growth in Nigeria do not show immediate responses in the desired direction. Policy makers need to be conscious of this lag in order to ensure appropriateness in the timing of policies in this regard.

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