



FOREIGN DIRECT INVESTMENT, NON-OIL EXPORTS, AND ECONOMIC GROWTH IN NIGERIA: A CAUSALITY ANALYSIS¹

Kolawole Olayiwola

Department of Economics and Development Studies Covenant University, Ota, Ogun State, Nigeria

Henry Okodua*

Department of Economics and Development Studies Covenant University, Ota, Ogun State, Nigeria

ABSTRACT

The study examines the contribution of Foreign Direct Investment (FDI) to the performance of non-oil exports in Nigeria within the framework of the export-led growth (ELG) hypothesis. Available evidence in Nigeria supports that the bulk of FDI inflow into the country goes to the oil sector of the economy. From the perspective of efficiency-seeking FDI, foreign capital always aims at taking advantage of cost-efficient production condition. Given this fact, a causality analysis was undertaken in order to verify the relevance of the ELG hypothesis. Also, the dynamic interaction among FDI, non-oil exports, and economic growth is investigated using the concept of variance decomposition and impulse response analysis. The results obtained from the causality analysis revealed that a unidirectional causality runs from FDI to non-oil exports. Each of the three variables exhibited on the average and at the early stages of the out-of-sample forecast period, a dormant response to one standard deviation shock or innovation. However, they all demonstrated significant responses after some 7 years into the out-of-sample forecast period. The results also show that an encouragement of non-oil exports is a necessity for an effective FDI in Nigeria. Therefore, in designing policies towards this direction, policy response lag need to be taken into consideration.

Keywords: FDI, Non-oil exports, Growth, Causality, Variance decomposition, Impulse response analysis.

JEL Classification: C33, C32, F43, F21

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INTRODUCTION

Nigeria achieved appreciable economic growth from 6.0% in 2006 to 6.5% in 2007. A number of explanations have been adduced for this observed trend by many scholars. During this period, non-oil exports performance also improved considerably. Other factors are rapid improvement in trade liberalization, concerted efforts towards diversification of 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 (Dinda, 2009) FDI can serve as an engine of growth and development by increasing the opportunity for the integration into global financial and capital market, expansion of employment and exports base, generation of technological capability-building and efficiency spillovers to local firms. It can also establish investment arrangements that increase the potential of host countries for economic growth.

Expectedly, the role of exports in enhancing economic performance also stands supreme. The major impetus for this relationship is the export-led growth (ELG) hypothesis which represents a dominant explanation in this context. Under the ELG hypothesis, a positive link between rising exports value and economic growth is envisaged. There are however inconclusive empirical evidences within the literature on the causal relationship between exports and growth. In particular, available time series studies fail to provide uniform support for the hypothesis while most cross-sectional studies provide empirical evidence in support of the hypothesis (Cuadros and Alguacil, 2001). Moreover, it can be argued that FDI is potentially, an important link in the export-growth relationship. Data from UNCTAD (2007) reveals an upward trend in FDI flows to Africa which 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 FDI. Out of this amount, Nigeria's oil sector is the major recipient as it attracted 90% of the FDI inflow.

Overall, empirical evidence indicates that FDI flows have been growing at a pace far exceeding the volume of international trade (Cuadros and Alguacil, 2001). According to the Central Bank of Nigeria CBN (2007), GDP growth rate was 6.5% in 2005, 6.0% in 2006, and 6.5% in 2007. This impressive performance in terms of GDP growth rate of 6.0% in 2006 to 6.5% in 2007 can arguably be attributed to a robust non-oil export growth rate of 26% in 2006 and 27% in 2007, as well as FDI growth rate of 163% and 172% in 2005 and 2006 respectively. Also, according to the International Monetary Fund, IMF (2008), the robust non-oil sector growth had offset the drag from a decline in oil production, by boosting growth in the Nigerian economy. This growth was driven mainly by major agricultural products such as yam, Irish and sweet potatoes, groundnuts, maize and services. The favourable economic environment caused by democratic rule and economic liberalization has made Nigeria attractive as destinations for private capital inflows. Net private capital inflows reached a record high level of N34, 440.2 million in 2007, from a meager

N3, 911.4 million seven years earlier in 2000. This dramatic increase was an attendant outcome of strong FDI inflows. However, the bulk of FDI is still targeted mainly to extractive industries, particularly the petroleum sector.

In Nigeria, despite the observed increasing inflows of FDI, there has not been any satisfactory attempt to assess FDI contribution to non-oil export, which remains a major channel through which FDI affects economic growth thereby compelling a number of questions. This call for an empirical analysis and the compelling questions are as follows: Can we find evidence to support the non-oil export led growth hypothesis in Nigeria? What vital role does FDI play in the ELG relationship? Are there any causal relationships or what are the dynamic interactions among non-oil exports, FDI, and economic growth in Nigeria? The basic objective of the study is to examine the contribution of FDI to the performance of non-oil export in Nigeria, within the framework of ELG hypothesis.

We proceed to section two of this paper with a brief survey of the related literature. Thereafter, methodology and data is dealt with in section three while the fourth section deals with the empirical findings or results. Section five is for summary and conclusions.

LITERATURE REVIEW

The export-led growth hypothesis postulates that exports are a main determinant of economic growth and the arguments here are as follows: first, that the export sector generates positive externalities on non-export sectors through more efficient management styles and improved production techniques (Feder, 1983). Second, export expansion increases productivity by offering potential for scale economies (Helpman and Krugman, 1985; Krugman, 1997). Third, exports alleviate foreign exchange constraints and provide greater access to international markets (Olayiwola, 2000). These arguments have recently been extended in 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 (Grossman and Helpman, 1991; Grossman and Helpman, 1995; Alisana and Rodrik, 1999).

The ELG hypothesis appears to be quite popular even in the face of conflicting related empirical evidence based on time series studies to support its major propositions. It is interesting also to note that a positive link between exports and growth are obtained mostly from cross-sectional studies of the relationship. However, these cross-country studies results are subject to extreme limitations and must therefore be treated with great caution. These limitations are outlined in Giles and Williams (2000). They include the implicit assumption of a common economic structure and similar production technology across different countries and this appears an over-simplification of reality. Second, the economic growth of a country is influenced by a host of domestic policies such as monetary, fiscal and external policies, which are excluded from the analysis. Also, cross-country

regressions take positive associations as evidence of causation and provide little insight into the way exports affect growth.

There are a number of ways through which trade flows and FDI are linked. [Goldberg and Klein \(1997\)](#) asserted that FDI encourage export promotion, import substitution, or greater trade in intermediate inputs which often exist between parent and affiliate producers. The orientation of investments by multinational firms is towards exports and this serves 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](#)). [De Gregorio \(2003\)](#) finds that FDI 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. [Balasubramanyam et al. \(1996\)](#) using cross-sectional data and OLS regressions, 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.

[Chang \(2006\)](#) finds that both economic growth and exports positively impacts on FDI inflow but export expansion has a negative impact on FDI outflow and FDI inflow has a positive impact on exports and economic performance. [Ahci and Ucal \(2003\)](#) finds results that are in line with the ELG hypothesis, but do not confirm the existence of FDI-growth nexus. The study failed to find significant positive spillovers from FDI to output and could not suggest a kind of FDI-led export growth linkage. [Sharma \(2000\)](#) employed a simultaneous equation framework to show that foreign investment does not have a statistically significant impact on export performance even though the coefficient of FDI has a positive sign. [Yao \(2006\)](#) found that both exports and FDI have a strong and positive effect on economic growth and opined that export promotion and adoption of world technology and business practices are useful policy options for developing and transition economies desiring to attract more FDI. The result of the study by [Cuadros and Alguacil \(2001\)](#) did not indicate any evidence in support of the ELG hypothesis; however, they found that FDI significantly impacted on economic growth and trade.

[Kehl \(2008\)](#) examines the interaction of foreign investment with democratic institutions and government effectiveness, measured as the ability to formulate and implement policy. The study posits that democratic institutions and government effectiveness have a positive effect on the capacity of governments to negotiate benefits from foreign investment. It is noteworthy to emphasize that these results strongly suggest that foreign investment may only promote economic growth when there is effective interaction of international investments with domestic democratic development. [Fontagné \(1999\)](#) finds evidence indicating that foreign investment abroad stimulates the growth of exports from originating countries (investing countries) which in consequence, is complementary to trade. Using an analysis of 14 countries, the study demonstrated that each dollar of outward FDI produces about two dollars' worth of additional exports. On the contrary, host

countries short-term foreign investment flows often demonstrate a tendency to increase imports, while an increase in exports tends to appear in the long-term.

In Nigeria, there exist a number of studies on FDI-growth nexus. Otepolo (2002) reported that the human capital (labour) available in Nigeria is not FDI inducing. As noted by Akinlo (2004), exports and economic growth in Nigeria are positively correlated. Ayanwale and Bamire (2001) found a positive spillover of foreign firms FDI on domestic firm's productivity in Nigeria and went ahead to conclude that FDI influences firm level productivity in the country. Adelegan (2000) explored the seemingly unrelated regression to show that FDI is pro-consumption and pro-import and negatively related to gross domestic investment.

Ayanwale (2007) 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. Using a bivariate VAR modeling structure, Herzer *et al.* (2006) found evidence in support of a positive FDI-led growth in Nigeria, Sri Lanka, Tunisia, and Egypt. Using a 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 found by Okodua (2009) who used the Johansen cointegration to find evidence of a long-run equilibrium relationship between economic growth and FDI inflows and also, a owe-way causality from FDI to economic growth

The majority of these studies are without doubt, unanimous on a positive FDI – growth relationship in Nigeria. However, a similar conclusion cannot be made in the case of the Export–FDI relationship. Moreover, no study linking the role of FDI in the non–oil export – growth relationship in Nigeria could be cited from available related literature.

METHODOLOGY

The analytical procedure adopted in this study include: the specification of 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.

The baseline empirical model is specified to capture the hypothesized relationship among the core variables namely: FDI, non-oil export, and GDP. In doing this, the endogenous growth theory is a useful guide. This theory emphasizes the role of exports in determining long-run growth via a higher rate of technological innovation and dynamic learning from abroad (Romer, 1986) (Lucas, 1988). The specified model is provided as follows:

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

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 Exports¹.

Equation (1) is specified in econometric form as:

$$\text{Growth}_t = \delta_0 + \delta_1 \text{FDI}_t + \delta_2 \text{NOX}_t + \nu_t \quad (2)$$

δ_0 denotes the intercept term, δ_i are slope coefficients, ν_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 ground, 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. 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, hence, there is usually a compelling need to devote a considerable time to the selection of the lag structure. The selected lag length(s) are thus those that reduce autocorrelation in the model. 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).

Given that a set of g variables ($g = 3$ in this case) is under consideration, the starting point 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 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):

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

A typical VECM in its simplest form appears 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 $\Gamma_i = \left(\sum_{j=1}^i \beta_j \right) - I_g$

Π is the matrix of coefficients and it contains information on the possible cointegrating relations between the n elements of the stochastic process, y_t . The Johansen test is very sensitive to the lag length employed in the VECM. This implies that too few lags will not remove all of the autocorrelation, thus biasing the results. Also the inclusion of too many lags will increase the

coefficient standard errors since the additional parameters will simply use up available degrees of freedom (Brooks, 2008). 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. In order to determine the optimal lag lengths, we employed the multivariate generalization of Akaike's information criterion (AIC)ⁱⁱ.

The Johansen test centers around an examination of the Π matrix. At equilibrium, all the Δy_{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 rank of the Π matrix via its eigen-values provide valuable information under the test for cointegration. For the Johansen procedure, there are two test statistics for the number of cointegrating vectors: the trace (λ_{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. 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 $r=2$.

The second step is Cointegration and Granger causality analysis. Two or more variables are said to be cointegrated when they exhibit long-run equilibrium relationship(s), and/or if they share common trend(s). The pioneering works 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 VECM derived from the longrun cointegrating vectors. Testing for Granger-causality, requires checking whether specific coefficients are zero, hence, standard testsⁱⁱⁱ for zero restrictions on VAR coefficients are often employed.

One major drawback with cointegration analysis is that these tests for cointegration turn each series stationary mechanically by differencing the variables. This consequently eliminates 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 is also known as the speed of adjustment parameter and it captures adjustments of the model from short-run disequilibrium to long-run equilibrium trends.

The third step is Vector Error-Correction Modeling (VECM) and Exogeneity analysis. A corresponding error correction representation always exists in all cases where a number of variables 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). Given a VAR structure, all variables in the cointegrating equation are treated as endogenous variables. The VECM extends this by making use of differenced data and lagged differenced data of the chosen variables in a VAR structure. The error correction term is an essential element of the VECM. 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.

The ECM opens an additional channel for Granger causality^{iv} to emerge through the error-correction term. As explained in [Erjavec and Cota \(2003\)](#), we rely on the statistical significance of the F-tests. This 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 implies 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) indicates the ‘long-term’ causal relationship. The coefficient of the lagged error-correction term is a short-term adjustment coefficient. It represents the amount of errors or long-term disequilibrium in the dependent variable that is corrected in each period. The lagged error-correction term contains the log-run information, since it is derived from the long-term cointegration relationship(s). Weak exogeneity of the variable refers to ECM-dependence.

The fourth step is Impulse Response Functions (IRFs) analysis. The IRFs are obtained from the Moving Average (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. The responsiveness of the dependent variables in the VAR to shocks on each variable is revealed by the Impulse responses. 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](#)). In other words, a shock to the *ith* variable directly affects the *ith* variable and in addition, is transmitted to the other endogenous variables through the dynamic lag structure of the VAR. In this sense, an IRF traces out the effects of one time shock to one of the innovations of the current and future values of the endogenous variables. The fifth step is Variance Decompositions (VDCs) and Relative Exogeneity analysis. VDCs offer a slightly different method of 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 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. Variance decompositions in the true sense may be regarded 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.

RESULTS

The analysis of empirical results starts with the examination of the integration order of each of the time series included in the model. To achieve this, we apply two sets of unit root tests for stationarity and these include the Augmented Dickey-Fuller (ADF) and the Philips-Perron (PP) tests and the result are shown in Table 1. (Dickey and Fuller, 1979; Phillips and Perron, 1988).

Table-1. 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. 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. There is also the fact that each series is first difference stationary at the one percent level using the PP test. The basic implication is that the presence of a unit root for any of the variables under the PP tests cannot be rejected. However, the ADF test result is not impressive because only the growth variable passed the differenced stationarity test at 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.

The results of co-integration using the Johansen Approach are presented in table 2.

Table-2.Result of the Co-integration using 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
 $\text{Growth} = 0.00258\text{FDI}$ (5)
 (11.68)

Cointegrating coefficient normalized on NOX
 $\text{NOX} = 0.325128\text{FDI}$ (6)
 (12.66)

Notes:

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 both the Akaike and Schartz information criteria for the selection of the optimal lag interval of (1,1).

The result in the normalized cointegrating equation (5) shows that in the long-run, FDI affects economic growth positively in Nigeria. This positive effect of FDI on growth, though significant, is unimpressively low as only about one percent change in economic growth will arise from a hundred percent change in FDI inflows 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 non-oil exports 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).

The results of the temporal causality based on Vector Error Correction Model analysis are presented in table 3.

Table-3. Temporal causality based on VECM

Dependentvariable	ΔGrowth	ΔNOX	ΔFDI	ECT_{t-1}
	F-statistics (P-Values)			t-statistics
ΔGrowth	-	0.8951	0.3836	-0.11202
ΔNOX	0.7402	-	0.0000*	0.86351
ΔFDI	0.9681	0.7803	-	-5.42631*

*Note: All variables are in first differences (denoted by Δ)
except the lagged error correction term (ect_{t-1})
The ect_{t-1} were generated from the Johansen co-integration test
* denotes significant at 1 percent level*

Diagnostic tests conducted for various orders of serial correlation, normality and heteroscedasticity were in general considered satisfactory. The results indicate the presence of a unidirectional short-run causality running from FDI to non-oil exports. All other combinations fail 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. This implies 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. In table 4, we employ a ten year forecasting (out of sample forecast) horizon to present results of Variance Decompositions based on VECM Results.

Table-4. Variance Decomposition

Forecast Year	Relative Variance In:	Percentage of Forecast Variance Explained by innovations in					
		Δ GROWTH		Δ NOX		Δ FDI	
		I	II	I	II	I	II
1	Δ 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	Δ 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	Δ 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

The ordering of variables is of immense importance in decomposition of variance. This relevance can be seen between the values under orderings I and II over the same forecasting horizon. 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.

During the forecast year one, shocks to *growth* accounted for 0.41% and 0.00% of the variations in *NOX* using orderings I and II respectively. Shocks to *NOX* accounted for 99.58% and 63.13% of the variations in *NOX* using orderings I and II respectively. *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 a unidirectional causality from *FDI* to *NOX*.

The Impulse Response Analysis also shows that that ordering of variables has an effect on the impulse response functions. In the absence of any theory compelling an obvious ordering for the series, the logical thing to do is to undertake some sensitivity analysis. The impulse response functions are in appendix 1.

Figures 1 and 2 of appendix 1 reveal the effects of one standard deviation shock on each of the variables over time. An interesting observation is that the impulse responses do not appear to be very sensitive to the ordering of variables. Another striking feature 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.

CONCLUSIONS

The study examined the role of FDI in the non oil exports – growth nexus. A causality analysis of the relevant variables was undertaken in order to verify the relevance of the ELG hypothesis to the Nigerian economy. Empirical evidence failed to support the export-led growth hypothesis in Nigeria. Besides, the analysis of the dynamic interaction among FDI, non-oil exports, and growth using the concept of variance decomposition and impulse response analysis supports a unidirectional causality from foreign direct investment to non-oil export. Each of the three variables exhibited on the average and at the early stages of the out-of-sample forecast period, a dormant response to one standard deviation shock or innovation. However, they all demonstrated significant responses after some 7 years into the out-of-sample forecast period.

It is therefore important to note here that policy shocks to FDI, non-oil exports, and economic growth in Nigeria do not show immediate responses in the desired direction. This may also be attributable to less significant contributions of non-oil exports to total exports. There is the need for the encouragement of non-oil exports in order for FDI to contribute meaningfully to economic growth in Nigeria. Policy makers need to be conscious of the response lag in order to ensure appropriateness in the timing of policies in encouraging FDI and non-oil export.

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Appendix-1. Impulse Response Functions

Figure-1. Impulse Response Function (Ordering I – Growth, NOX, FDI)

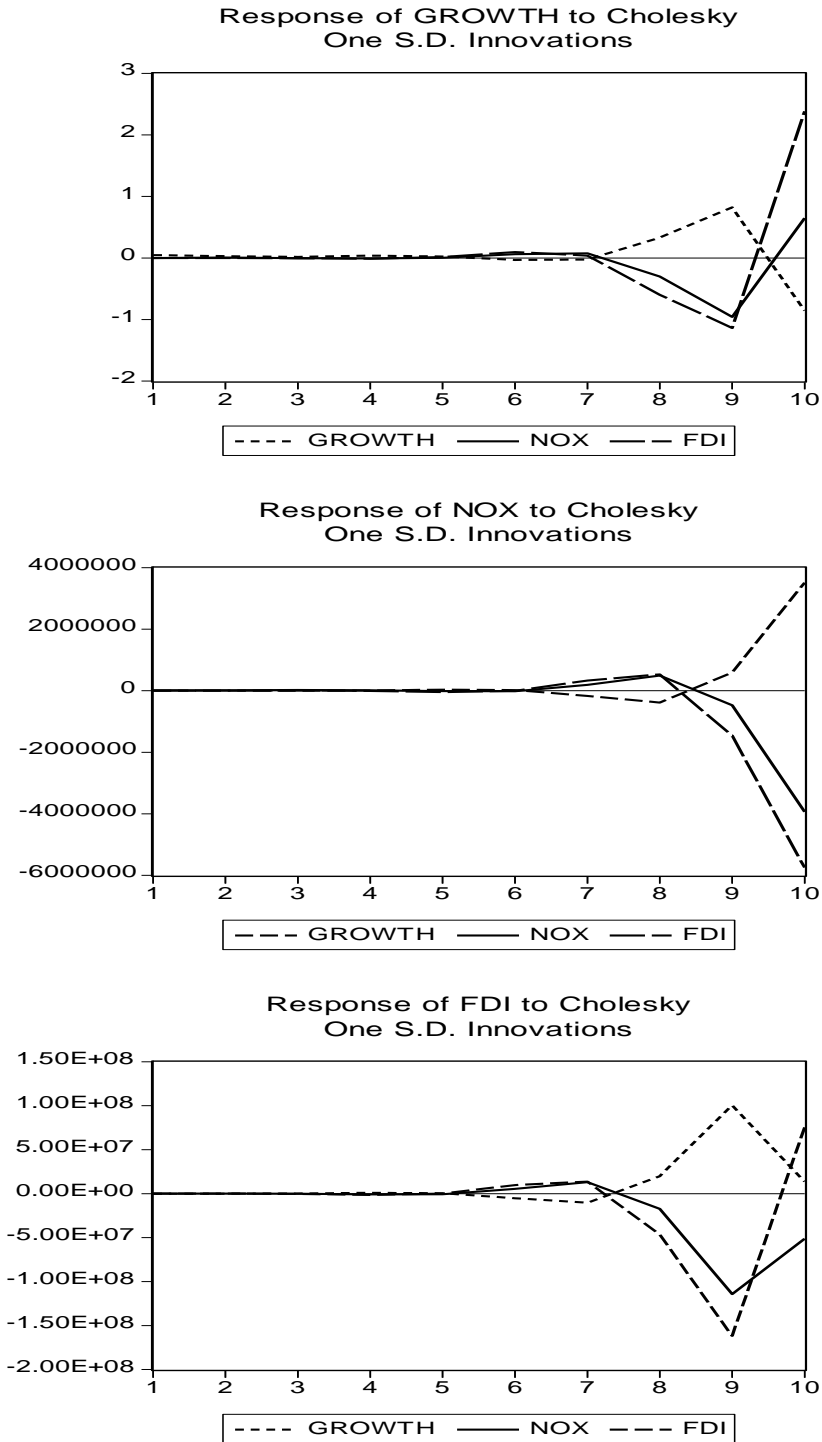
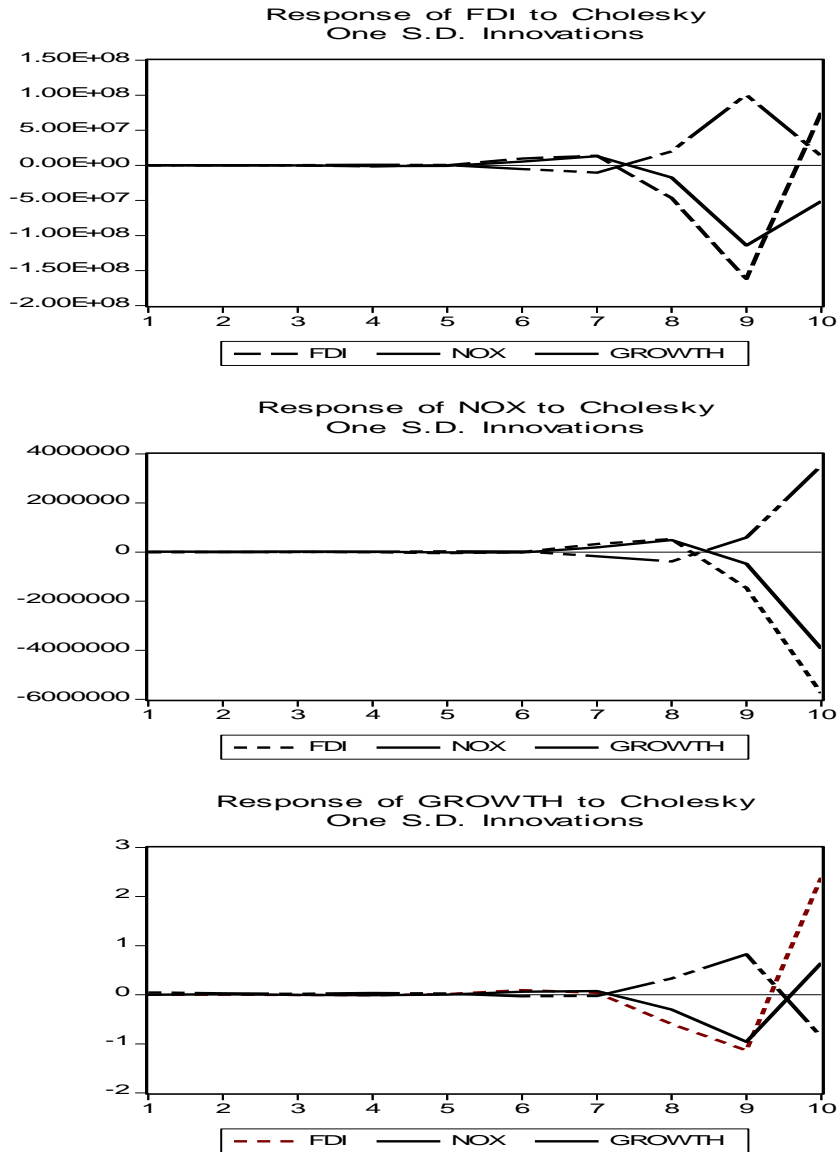


Figure-2. Impulse Response Function (Ordering II - FDI, NOX, GROWTH)



Endnotes

ⁱData on these variables from 1980 to 2007 are sourced from the Central Bank of Nigeria (CBN) Statistical.

ⁱⁱMost econometric softwares have facility for a multivariate information criterion which allows for comparison across information criteria for use in this regard.

ⁱⁱⁱ χ^2 - or *F*-tests based on the Wald principle are typically thought of in this context.

^{iv} This is usually ignored by standard Granger and Sims tests