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Full Length Research Paper

Foreign Direct Investment and Economic Growth in Nigeria: A Vector Error Correction Modeling

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Abstract

The aim of this study was to investigate the long-run equilibrium relationships among the international factors and economic growth, as well as, to assess the short-term impact of inward FDI, trade and domestic investment on economic growth in Nigeria from 1970 to 2010. A multivariate cointegration technique developed by Johansen and Juselius (1990) was employed to investigate the long-run equilibrium relationships. The results of the analysis affirmed the existence of cointegrating vectors in the systems of this country, during the study period (Lee and Tan, 2006). The variables in Nigeria models have a long-run equilibrium relationship with one another and were adjusting in the short-run via three identified channels. however, since the existence of cointegrating vectors (cointegration) in the system of a country only presumed the presence or absence of Granger-causality, which does not indicate the direction of causality between the variables, hence, the short-term impact of inward FDI, trade and domestic investment on economic growth in Nigeria was also tested via Granger Causality test, based on Vector Error-Correction Model. The results of the test revealed a short-run causal effect either running unidirectionally or bidirectionally among the variables for the country. Research implications were highlighted at the end of this report.

Keywords: Economic Growth, Foreign Direct Investment, Vector Error Correction Modeling, Nigeria.

INTRODUCTION

Debate in the literature on the perceived benefits of an increased openness to trade is on the increase; although few scholars advocate the imposition of trade restrictions (Rodriguez and Rodrik, 1999), the general feeling seems to be that traditional analyses may very well understate the true cost of protectionism since most of the analyses utilized static models, while ignoring the dynamic costs of trade protection (Saggi, 2002). Underlying this view is the notion, that, somehow, trade of goods and services, foreign direct investment (FDI) and interaction among countries in various other forms all play a crucial role in improving global allocation of physical resources and economic growth (Dollar, 1992; Sachs and Andrew, 1995).

The dynamic effects of trade have been studied extensively in the literature; much of the relevant studies emphasize two intertwined aspect of the relationship between foreign direct investment and economic growth (Saggi, 2002, p. 194). The benefits from free trade and from allowing the maximum benefits from FDI advancement have been well known. Many studies opined that free trade and investment enhances economic growth (Dollar, 1992; Sachs and Andrew, 1995; Rodriguez and Rodrik, 1999). Due to the general perceived positive spillovers from inward Foreign Direct Investment (FDI), the past two decades have seen most developing and emerging economies changed from a radical view of FDI and trade, toward a more friendly view, by using FDI and trade as strategies for positive spillovers to local firms, in their quest for development (Rodriguez and Rodrik, 1999). Consequently, international trade and foreign direct investment (FDI) are considered to be the two major channels that facilitate the flows of knowledge spillovers and economic growth (Sachs and Andrew, 1995).

Many theoretical and empirical studies have identified

several channels through which FDI may positively or negatively affect economic growth; theoretically, some identified channels include increased domestic investment in capital accumulation in the host country, improved efficiency of indigenous firms, via contract and demonstration effects, and their exposure to fierce competition, technological change, and human capital augmentation and increased exports (Aitken et al., 1997; Blomstrom and Kokko, 1997, 1998). According to Buckley et al. (2002b), the extent to which FDI contributes to growth depends on the economic and social condition of the host country; although, host countries with high rate of savings, open trade regime and high technological product would benefit from increase FDI to their economies.

Given the impact of trade and FDI on economic growth and development, a survey on the role of trade and FDI as channels (Saggi, 2002) of domestic investment and growth is imperative, hence, the specific objectives of this paper are multi-fold: (1) to investigate the long-run equilibrium relationships among the international factors, domestic investment and economic growth in Nigeria; the international factors comprised FDI flows, and trade; (2) to assess the short-term impact of inward FDI, trade and domestic investment on economic growth in Nigeria.

REVIEW OF RELEVANT LITERATURE

Foreign Direct Investment and Economic Growth

Foreign Direct Investment (FDI), usually in form of Greenfield investment, mergers and acquisitions, or other cooperative agreements, has been a major source of skills, equipments, productivity and economic growth, majorly from developed countries to developing countries; this is based on the notion that domestic firms in developing countries benefit from the FDI externalities through improved productivity, employment, exports and international integration (Costa and De Queiroz, 2002; Lall, 1997). In supporting favourable disposition of countries toward encouraging FDI, advocates of free market economy claim that, MNEs generate Spillovers which benefit the host economy, which are usually reflected in improved productivity, know-how, and other benefits (Fosfuri et al., 2001). The theory of the effect of trade policy regime on FDI, trade and growth in a given host country was first presented by Bhagwati (1978) as an extension to his theory of immiserizing growth and further developed by Bhagwati (1985 and 1994); Brecher and Diaz-Alejandro (1977); Brecher and Findlay (1983); known as the “Bhagwati hypothesis”, it postulates that FDI inflows coming into a country in the context of a restrictive, import-substitution (IS) regime can retard, rather than promote growth; this is because in an IS regime, FDI mostly take place in sectors where the host developing country does not have comparative advantage, hence, FDI becomes an avenue for foreign companies to maintain their market share and to reap the extra profit, the economic rent, created by the highly protected domestic market.

On the other hand, under the export promotion (EP) regime, the main incentives for FDI in a given host country are the relatively low labor cost and/or the availability of raw materials; this allows the foreign investors to operate in an environment that is relatively free from distortions and to increase production of internationally competitive and export oriented product lines; in addition, since the production of firms in an EP regime is not limited by the size of the domestic market, there is increased potential for foreign companies to reap economies of scale through international market penetration (Edwards, 1998; Kohpaiboon, 2002) . It is imperative to know that, despite the unique advantages of FDI, local policies of the host country, especially in developing nations, often makes pure Foreign Direct Investment infeasible, so foreign firms choose licensing or joint ventures (Saggi, 2002).

Some empirical studies (Chakraborty and Basu, 2002; Love and Chandra, 2004) also supported the theory that trade and FDI function as engines of growth, through government’s trade and FDI liberalization policies; this is also collaborated in Tian et al. (2004), by stating that, increased FDI ratio is likely to lead to rapid economic growth, hence, Tian et al. concluded that FDI and trade should be encouraged in the less developed economies to accelerate technological change and economic growth, since the two serves as motivation for the advanced countries to be more innovative and allow developing countries to draw upon the stock of knowledge created by their innovations. Contrary to these positive conclusions, past studies on the impact of trade and FDI on economic growth have produced mixed results; Basant and Fikkert (1996), Singh (2003) and Young and Lan (1996) are not so optimistic about the importance of trade and FDI in the growth process. Singh (2003), argued that trade contributes to productivity growth in only some unique industries, rather than all industries in an economy. Other studies like Young and Lan (1996), observed that, FDI flows from industrialised countries have more weight in the diffusion of technology than those from developing countries; while Chakraborty and Basu (2002) warn that the impact of FDI on growth is not always positive, a warning that is also shared by Greenaway and Sapsford (1994) and Behzad and Reza (1995) about the impact of trade in the diffusion of technology on economic growth.

FDI may have negative effect on the growth prospect of the host economy if they give rise to a substantial reverse flows by the activities of the TNCs, in the form of remittances of profits, dividends and substantial concessions from the host country (Akinlo, 2004). Many empirical works have also been provided on the causal relationship between FDI and growth; at the firm level,

several studies provided evidence of technological spillover and improved plant productivity, while, at the macro level, FDI inflows in developing countries tend to "crowd in" other investment; however, most studies found that FDI inflows led to higher per capita GDP, increase economic growth rate and higher productivity growth (Markusen & Venables, 2005; Akinlo, 2004). Other important channels of significant FDI and growth relationships include higher export in host country and increased backward and forward linkages with affiliates to multinationals (Markusen & Venables, 2005); however, role of host country factors of production in determining the extent of foreign capital productivity must not be underestimated, these factors comprise among others, introduction of advanced technology, absorptive capacity in the host country, level of human capital in a recipient economy and some degree of complimentarity between domestic investment and FDI (Akinlo, 2004). In summary, despite the general believe that inflows of physical capital resulting from FDI could increase the rate of economic growth, Johnson (2006) argued in his paper that the most important effect comes from spillovers of technology; MNE operations in the host country can result in technology spillovers from FDI, whereby domestic firms adopt superior MNE technology which enables them to improve their productivity, hence, technology spillovers thereby generate a positive externality allowing the host country to enhance its long-run growth rate. Notwithstanding, the simplicity of the argument, empirical evidence on a positive relationship between FDI inflows and host country economic growth has been elusive; even when a relationship between FDI and economic growth is established, it often depends on host country characteristics such as the level of human capital, absorptive capacity of the host country, infrastructural facilities and stability in the polity (Borensztein et al., 1998).

Transmission mechanisms between FDI and Economic Growth

Through initial macroeconomic stimulus, FDI is thought to contribute to economic growth and development, by raising total factor productivity and efficiency of resource use in the host economy through transfer of more advanced technology and organizational forms directly to MNC affiliates in the host country; in addition, FDI could also trigger technological and other spillovers to locally owned enterprises, assisting human capital formation, contributing to international trade integration, helping to create a more competitive business environment, enhancing enterprise development and general improvement in environmental and social conditions of the host country (Blomström et al., 2000; Ikiara, 2003). As illustrated in figure 1, these transmission mechanisms could ultimately lead to higher economic growth, which is the most potent tool for poverty reduction in developing countries; that notwithstanding, it is often believed that growth is not a sufficient condition for poverty alleviation, since, there is evidence that higher incomes in developing countries benefit the poor segments of the population proportionately (Okejiri, 2000).

According to neoclassical theory, FDI influences income growth by increasing the amount of capital per person, but does not influence long-run economic growth due to diminishing returns to capital; in addition, recent endogenous growth theorists (e.g., Romer, 1986; 1990 and Lucas, 1988), argue that FDI spurs long-run growth through such variables as research and development (R&D) and human capital. They suggest that, through technology transfer to both affiliates and unaffiliated firms in the host economy, MNCs can speed up the development of new intermediate product varieties, raise product quality, facilitate international collaboration on R&D, as well as, introduction of new forms of human capital. However, in a deviation from many studies, few empirical studies, especially those using firm-level data, observed insignificant impact of FDI on economic growth and that FDI is no more productive than domestic investments (Kumar, 1996). Nevertheless, by controlling for simultaneity bias, country-specific effects, and proper use of lagged dependent variables in growth regressions, Carkovic and Levine (2002) observed positive impacts. Some of the studies showed marginal macroeconomic impacts, with FDI actually crowding out local investments and other types of foreign flows in some countries, and adversely affecting their current accounts (Ikiara, 2003). In addition, many studies (e.g., Balasubramanyam et al., 1996; Keller, 1996, 2002) also opined that FDI contributes to total factor productivity and income growth in host economies, over and above what domestic investment would trigger, and most specifically, policies that promote indigenous technological capability, such as education, technical training, and R&D, often increase the aggregate rate of technology transfer from FDI, while, export promotion trade regimes are also important prerequisites for positive FDI impact (Ikiara, 2003).finally, there is emerging consensus that FDI and trade are mutually reinforcing channels of crossborder activities and that FDI contributes, in the long term, to the integration of the host economy more closely into the global economy (Keller, 2002). There seem to be divergent opinion on the relationship between FDI and trade; while Fairchild and Sosin (1986) and Kumar (1990) reported insignificant relationship between FDI and export, others, such as Willmore (1992), observed positive relationship (Ikiara, 2003).

Trade and Foreign Direct Investment (FDI) in Nigeria

The Heckscher – Ohlin Theorem states that countries tend to export the goods whose production is intensive in

factors with which they are abundantly endowed (Mahe, 2005); due to lack of capacity development, Nigeria relies on United States, UK and Western Europe for the importation of strategic capital goods like Machineries and equipments, where it lack comparative advantage, while the greater percentage of her exports, mostly primary products, are targeted toward U.S markets. Given the importance of trade, many scholars opined that, international trade can make a decisive contribution to sustainable development by promoting the equitable integration of Nigeria into the global economy, which can significantly boost economic growth; however, trade and investment liberalization will provide maximum benefit to Nigeria when it is operating within a sound supporting domestic policy framework and pursued in tandem with political will" (Mahe, 2005). Moreover, considering the dilapidated state of Nigeria's infrastructure, the option of locating in a self-contained free trade zone (FTZ) is compelling; tax concessions and other incentives form an added benefit, improving bottom line profitability and project returns. After a slow start, the Nigerian government is again talking up the benefits of FTZs and fresh opportunities are emerging for investors, hence, investors will need little persuasion to set up in a more stable and cost-efficient environment (Eedes, 2005).

In a research conducted by Ibrahim and Onokosi-Alliyu (2008), using cointegration techniques, the paper examines the determinants of Foreign Direct Investment (FDI) in Nigeria during 1970 – 2006, the results observed that the major determinants of FDI were market size, real exchange rate and political factor; furthermore, by performing simulations using impulse response and variance decomposition analysis, the result advised against uncontrolled trade liberalization. In a related research by Akinlo (2004), the paper explored the impact of foreign direct investment (FDI) on economic growth in Nigeria, for the period 1970–2001, the ECM results showed an insignificant impacts of both private capital and lagged foreign capital on the economic growth; the results seem to support the argument that extractive FDI might not be growth enhancing as much as manufacturing FDI. In addition, the output of this extensive research, showed that export has a positive and statistically significant effect on growth, while financial development, measured as M2/GDP ratio, has significant negative effect on growth, which might be due to high capital flight it generates; finally, the research observed that labour force and human capital have significant positive effect on growth, hence, a suggestion for labour force expansion and education policy to raise the stock of human capital in the country (Akinlo, 2004).

Given the pattern of FDI flows to Nigeria (mostly in oil sector) and the apprehensions as regards the benefits from extractive FDI, several factors suggest that the indirect benefits of FDI may be less in extractive (especially oil) industries; this is due to the fact that extractive sector (such as oil subsector) is often an enclave sector with little linkages with the other sectors.

Finally, according to Akinlo, backward and forward linkages in technology transfer are less important in extractive FDI, as production in natural or primary resource sector requires fewer inputs of materials and intermediate goods from local suppliers due to its high capital intensive nature cum the fact that sales are foreign market oriented. Based on recent trends, there is high expectation that much of this investments would be supported by private international inflows, mainly from China, Russia and the Middle East; there is also expectation of a continue influx of capital from the official donor sector, which will likely be targeted towards longer-term large-scale infrastructure investments, as well as Nigeria's budget (Leigh, 2008). It is important for developing countries to know that, contrary to expectations, trade and FDI may not lead to growth, rather, may increase both markets and economic risks; however, adequate provision should be made for all risks associated with FDI and trade, since increases risk premium, discourages investment, as well as lower capacity of domestic firms, as a result of enhanced and unbalanced competition in the new 'globalised world'. According to Solow (1956), the most important determinant of growth is technological change, hence, developing countries should focus on the impact of policies on technological change, as well as, the diffusion of knowledge from developed countries; efforts should also be made to internalize knowledge transfers within the developing economies.

DATA AND METHODOLOGY

Data Source

The following sources of data were used in this paper: Import of Machinery (IMPM) data was collected from United Nations Commodity Trade Statistics (UNCTS) Database, and World Trade Organisation (WTO) Statistics database. Real Gross Domestic Product per capital (GDP), Export and Import data were sourced from United Nations Statistics Database (UNdata), United Nations Conference on Trade and Development (UNCTAD) handbook of statistics, and World development indicators (WDI) ONLINE (World development indicators online). FDI and Domestic investment figures were from United Nations Conference on Trade and Development (UNCTAD) FDISTAT Database, International Monetary Fund (IMF), and United Nations Statistics Database (UNdata). Other sources are International Monetary Fund (IMF) Database, International Financial Statistics (IFS) of the World Bank; publications of central bank of Nigeria and other agencies of government. The empirical results were produced using EVIEWS 6.0.

Table 1. The results of Augmented Dickey-Fuller (ADF) Test (Ho: a unit root)

	Level		First Difference	
Variables	**Constant without Trend**	**Constant with Trend**	**Constant without Trend**	**Constant with Trend**
Nigeria Model Variables				
DI	0.124335	-0.309808	-3.145541**	-3.361598***
EXP01	2.514984	1.442281	-3.301828**	-3.687529**
FDI	0.993062	-0.704361	-5.639046*	-6.088482*
GDP	0.172443	-3.352558	-6.807686*	-6.722904*
IMP	-0.282022	-0.737150	-4.567816*	-4.563187*
IMPM	1.268557	-0.224709	-5.805208*	-6.405380*

Note: Asterisks *, ** and *** denote statistical significant at 1%, 5% and 10% respectively. Lags are selected automatically by EViews 6.0.

Table 2. The results of Phillips-Perron (PP) Tests (Ho: a unit root)

	Level		First Difference	
Variables	**Constant without Trend**	**Constant with Trend**	**Constant without Trend**	**Constant with Trend**
Nigeria(N) Model Variables				
DI	0.439370	-0.148130	-2.65569***	-2.604309
EXP01	2.320468	0.972072	-3.30182**	-3.74274**
FDI	1.763926	0.704361	-5.641124*	-6.086636*
GDP	0.018424	-2.356968	-6.769487*	-6.689742*
IMP	-0.809650	-1.275888	-4.613034*	-4.607808*
IMPM	1.599318	-0.295587	-5.888616*	-6.383675*

Note: Asterisks *, ** and *** denote statistical significant at 1%, 5% and 10% respectively. Lags are selected automatically by EViews 6.0.

Methodology

This research employed time series data of the selected country, from 1970 to 2010, by using multivariate cointegration analysis, Granger-causality tests within the framework of Vector Error-correction Model (VECM) to analyse the dynamic relationships among FDI, international trade, economic growth and domestic investment in Nigeria (Johansen and Juselius, 1990).

Econometric Model

According to Asteriou and Hall (2007), econometric methods (models) can help to overcome the problem of complete uncertainty, by providing guidelines on planning and decision-making, as well as, a way of examining the nature and form of the relationship among the variables. However, since models need to meet certain criteria in order to be valid, building up a model is not easy; hence, a good decision-making is required on the variables to include in the model, so as not to cause unneeded variables misspecification problem (too many variables) or omitted variables misspecification (Asteriou and Hall, 2007). Thus the following models were formulated:

$$IMPM_t = a_1 + a_2 FDI_t + a_3 GDP_t + a_4 DI_t + a_5 EXP01_t + a_6 IMP_t + \varepsilon \ldots. \text{ equation (1)}$$

$$FDI_t = b_1 + b_2 IMPM_t + b_3 GDP_t + b_4 DI_t + b_5 EXP01_t + b_6 IMP_t + \varepsilon \ldots \text{ equation (2)}$$

$$GDP_t = c_1 + c_2 IMPM_t + c_3 FDI_t + c_4 DI_t + c_5 EXP01_t + c_6 IMP_t + \varepsilon \ldots \text{ equation (3)}$$

Table 3. The results of Kwiatkowski-Phillips-Schmidt-Shin (KPSS) Test, Null Hypothesis: Ho: Model is stationary

	Level		First Difference	
Variables	**Constant without Trend**	**Constant with Trend**	**Constant without Trend**	**Constant with Trend**
Nigeria Model Variables				
DI	0.325089**	0.14051***	0.293300	0.158950**
EXP01	0.507892**	0.14550***	0.195006	0.178243**
FDI	0.745004*	0.13006***	0.315861	0.117715
GDP	0.736431**	0.072152	0.116336	0.105210
IMP	0.414510**	0.112198	0.173065	0.133714
IMPM	0.648086**	0.14437***	0.321293	0.109837

Note: Asterisks *, ** and *** denote statistical significant at 1%, 5% and 10% respectively. Lags are selected automatically by EViews 6.0.

$$DI_t = d1 + d_2 IMPM_t + d_3 FDI_t + d_4 GDP_t + d_5 EXP01_t + d_6 IMP_t + \varepsilon \ldots \text{equation (4)}$$

$$EXP01_t = e1 + e_2 IMPM_t + e_3 FDI_t + e_4 GDP_t + e_5 DI_t + e_6 IMP_t + \varepsilon \ldots \text{equation (5)}$$

$$IMP_t = f1 + f_2 IMPM_t + f_3 FDI_t + f_4 GDP_t + f_5 DI_t + f_6 EXP01_t + \varepsilon \ldots \text{equation (6)}$$

Where
IMPM = Imports of machinery for host country
FDI = Foreign Direct Investment inflow to host country
GDP = Real Gross Domestic Product for host country
DI = Domestic investment of host country
EXP01 = Exports of host country
IMP = Imports of host country
ε = disturbance
a1…a7 = unknown population parameters

The econometric model used in this analysis was based on past theoretical and empirical research of Kim and Seo (2003) and Lee and Tan (2006), Madsen (2007), Pottelsberghe and Lichtenberg (2001); the model, as specified above, was in the form of a vector autoregressive model (VAR) as used in Lee and Tan (2006, p. 397). I tried to identify the impact of FDI in Nigerian economy through equation (2); while the impact of FDI, international trade and domestic investment towards economic growth (GDP) will be determined through equation (3). However, since Akaike Information Criterion-AIC (Akaike, 1974) is one of the most commonly used in time series analysis, and for the fact that both AIC and Schwarz Bayesian Criterion- SBC (Schwarz, 1978) are provided by EViews in the standard regression results output, both were considered in selecting the models for this study (Asteriou and Hall, 2007).

RESULTS AND FINDINGS

The estimated results of unit roots test

Due to the significance of the unit root in determining both the cointegration and causality analyses, the series in this study was tested for unit roots via the standard Augmented Dickey – Fuller (ADF), Phillips – Perron (PP), and Kwiatkowski-Phillips-Schmidt-Shin (KPSS) tests. These tests were performed using a statistical package known as EViews 6.0, the package automatically selects the number of lagged dependent variables in order to correct for the presence of serial correlation (Asteriou and Hall, 2007). The standard ADF test was conducted for unit roots in the levels (for both constant without trend and constant with trend) and first difference (for both constant without trend and constant with trend), given the automatically selected Schwarz Info Criterion and the maximum lags, in order to determine the number of unit roots in the series of Nigeria variables; the result is reported in Table 1. Although, the test was started with level, the result showed a consistent results by rejecting the null (Ho: a unit root) hypothesis of a unit root at first difference, against the one-sided alternative whenever the ADF statistic is less than the critical value, at a statistically significant values of 1%, 5% and 10%. Hence my conclusion is that the series is stationary.

Although, the test was started with level, the result showed a consistent results by rejecting the null (Ho: a unit root) hypothesis of a unit root at first difference, against the one-sided alternative whenever the ADF statistic is less than the critical value, at a statistically significant values of 1%, 5% and 10%. Hence my conclusion is that the series is stationary.

Similar to the ADF test, PP test, for the country, was conducted for unit roots in the levels (for both constant without trend and constant with trend) and first difference (for both constant without trend and constant with trend).

The lag truncation was specified to compute the

Table 4. Johansen's test results for Multiple Cointegrating Vectors

Order of Cointegration		Trace		Maximum Eigenvalue	
Null	**Alternative**	**Statistics**	**C. V. (0.05 level)**	**Statistics**	**C.V (0.05 level)**
Nigeria Model					
Variables: IMPM, FDI, GDP, DI, EXP01, IMP (*P*=2)					
r = 0	r ≥ 1	300.2901 *	117.7082	117.2672*	44.49720
r ≤ 1	r ≥ 2	183.0229 *	88.80380	70.35526*	38.33101
r ≤ 2	r ≥ 3	112.6676 *	63.87610	55.84345*	32.11832
r ≤ 3	r ≥ 4	56.8241 *	42.91525	35.06454*	25.82321
r ≤ 4	r ≥ 5	21.75966	25.87211	17.18951	19.38704
r ≤ 5	r = 6	4.570152	12.51798	4.57015	12.51798

Note: r indicates the number of cointegrating vectors. Asterisk (*) indicates rejection at the 95% critical value. C.V. denotes Critical Value.

Newey-West heteroskedasticity and autocorrelation (HAC) consistent estimate of the spectrum at zero frequency, via the default Bartlett Kernel estimation method (Asteriou and Hall, 2007); the results, as reported in Table 2, presumed a rejection of null (Ho: a unit root) hypothesis of a unit root at first difference, against the one-sided alternative whenever the PP test statistic is less than the test critical values at a statistically significant values of 1%, 5% and 10%. Hence, my conclusion is that the series is stationary. The KPSS tests, for the country, was also conducted for unit roots in the levels (for both constant without trend and constant with trend) and first difference (for both constant without trend and constant with trend), via the default Bartlett Kernel estimation method and the Newey-West bandwidth; the results is reported in Table 3.

unlike the ADF and PP tests, null (Ho: model is stationary) hypothesis of a stationery model was rejected at levels, hence, the degree of integration of these variables was further confirmed by the KPSS test as the result of the test showed that the null hypothesis of KPSS test is non-stationary, which is the reverse to those of ADF and PP tests (Masih & Masih, 1996).

The test results of multivariate cointegration analysis

One of the major objectives of this study was to investigate the long-run equilibrium relationships among the international factors (international technology transfer- as proxy by import of machinery, FDI flows, and trade) and economic growth (as proxy by GDP) in Nigeria. The multivariate cointegration technique developed by Johansen & Juselius (1990) was employed to determine these relationships, since the variables in the systems of each country were I(1), and may possess some kind of long run relationship. The test results are reported in Tables 4.

After series of selection process using the likelihood ratio test with a potential lag length of 1 through 4, the results of the multivariate cointegration analysis reported in Table 4 indicated the existence of cointegrating vectors in the systems of this country. Based on the trace statistics, I observed from the results that there were four cointegrating vectors in the model of Nigeria (at a lag interval of 1 to 3). Although, only the trace statistics results are needed for the pantula principle method of model selection for cointegration testing, both the trace and the maximal eigenvalue statistics in my analysis indicated the existence of four cointegrating vectors for the Nigerian system (Asteriou and Hall, 2007). The interpretations of this (table 4) result implied that Nigerian models have a long-run equilibrium relationship with one another and were adjusting in the short-run via four identified channels (Lee and Tan, 2006). As stated earlier, if two variables are cointegrated, the finding of no-causality in either direction is ruled out and the typical trends are eliminated from the variables involved; although, the existence of cointegrating vectors (cointegration) in the systems of this country presumed the presence or absence of Granger-causality, it does not indicate the direction of causality between the variables; hence, the direction of the Granger-causality was detected through the vector error-correction model (VECM) derived from long-run cointegrating vectors (Granger, 1969; Lee and Tan, 2006). It is important to point out here that temporal precedence does not imply a cause and effect relationship, but establishing the order of the temporal precedence can be very useful to understanding the nature of the relationships and policy recommendations necessary to ameliorate the situation (Onafowora and Owoye, 2006).

The estimated results of Granger-causality tests

Part of the objectives of this study was to assess the short-term impact of inward FDI, trade and economic growth on international technology transfer into Nigeria during the selected period of study; the assessment involved testing the short-run Granger-causality among the variables for the country. For a Vector Autoregressive (VAR) first-differences system with cointegrated variables, as depicted by the models in my analysis, the Granger-causality test was conducted in the environment of VECM and the inclusion of the relevant error - correction terms,

Table 5. Granger Causality results based on Vector Error-Correction Model (Nigeria Model) (p=2)

Dependent Variable	Independent variable [Wald Test Chi Square (Significance level)]							
	ΔIMPM	**ΔFDI**	**ΔGDP**	**ΔDI**	**ΔEXPO1**	**ΔIMP**	**ECT$_{t-1}$ terms**	
ΔIMPM	------		0.774603	13.2586*	6.84582***	9.0264**	3.618038	20.3855*
			0.8555	0.0041	0.0770	0.0289	0.3058	0.0004
ΔFDI	4.581385		-------	13.27705*	13.39065*	16.9366*	10.123**	25.2264*
	0.2051			0.0041	0.0039	0.0007	0.0175	0.00001
ΔGDP	2.813294		16.6522*	------	7.57411***	2.172380	7.059***	23.0014*
	0.4213		0.0008		0.0557	0.5374	0.0700	0.0001
ΔDI	1.645923		0.036294	4.743651	------	5.298446	0.434144	4.623892
	0.6490		0.9982	0.1916		0.1512	0.9331	0.3281
ΔEXP01	6.668***		2.62633	21.9823*	17.17398*	--------	15.1570*	32.0661*
	0.0832		0.4529	0.0001	0.0007		0.0017	0.00001
ΔIMP	8.8948**		9.6301**	2.902335	2.600274	6.994***	--------	17.3805*
	0.0307		0.0220	0.4069	0.4574	0.0721		0.0016

Note: Asterisks *, ** and *** denote statistical significant at 1%, 5% and 10% respectively; this system consists of 4 (four) cointegrating vectors; hence, a joint Wald test is conducted on the 4 (four) error-correction terms (ECTs). The estimated result is reported in the last column (ECT$_{t-1}$ terms) of the table.

Table 6. Testing the Hypothesis

Construct Association	'α' level	ρ-value	Significant (yes/no)	Hypothesis
IMPM on GDP	0.05	0.4213	No	Accept H0
FDI on GDP	0.05	0.0008	Yes	Reject Ho; Accept H1
DI on GDP	0.10	0.0557	Yes	Reject Ho; Accept H1
EXP01 on GDP	0.05	0.5374	No	Accept Ho
IMP on GDP	0.05	0.0700	Yes	Reject Ho; Accept H1

Note: α level denotes significant level

so as to avoid misspecification and omission of important constraints.

The wald test chi square of the explanatory variables (in first-differences) indicates the 'short-run' causal effects, whereas the 'long-run' causal relationship is implied through the significance or otherwise of the lagged 'group' error correction term (ECT$_{t-1}$ terms) which contains the long-run information (Lee and Tan, 2006). Table 5 shows the Granger-causality result based on the VECM for the Nigerian models. The Wald test Chi Square (at various significance levels of 1%, 5% and 10%), for the lag values of the independent variables indicated a short-run causal effect either running unidirectionally or bidirectionally between the variables. The joint Wald test conducted on the four (Nigeria) error-correction terms (ECTs), as reported in the last column (ECT$_{t-1}$ terms) of tables 5, exemplified the burden of short-run endogenous adjustment (to long-run trend) to bring the system back to its long-run equilibrium (Lee and Tan, 2006).

Forecasting Model and Hypothesis Testing

To test the short run causal relationship between econo-

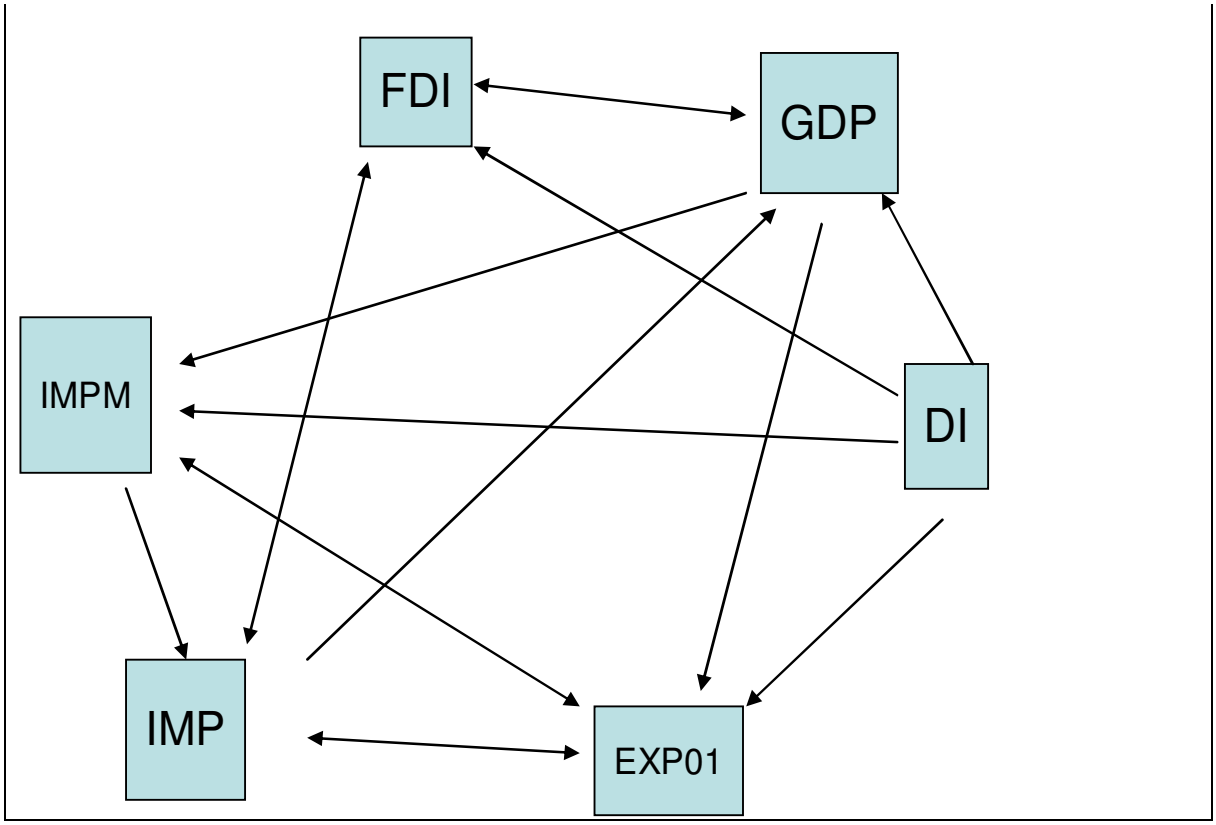

Figure 1. Short-run lead-lag linkages summarized from VECMs for Nigeria Variables.

mic growth (exogenous construct) and the various endogenous constructs (trade, FDI, DI), the following regression model were analyses, and the underline hypotheses tested using Statistical Package for Social Sciences (SPSS) version 15.0:

Granger Causality hypothesis and equations based on Vector Error-Correction Model for Nigeria

$$\Delta GDP_t = C(47)\ ECT^{1}_{t-1} + C(48)ECT^{2}_{t-1} + C(49)ECT^{3}_{t-1} + C(50)\ ECT^{4}_{t-1} + C(51)\ \Delta IMPM_{t-1} + C(52)\ \Delta IMPM_{t-2} + C(53)\ \Delta IMPM_{t-3} + C(54)\ \Delta FDI_{t-1} + C(55)\ \Delta FDI_{t-2} + C(56)\ \Delta FDI_{t-3} + C(57)\ \Delta GDP_{t-1} + C(58)\ \Delta GDP_{t-2} + C(59)\ \Delta GDP_{t-3} + C(60)\ \Delta DI_{t-1} + C(61)\ \Delta DI_{t-2} + C(62)\ \Delta DI_{t-3} + C(63)\ \Delta EXP01_{t-1} + C(64)\ \Delta EXP01_{t-2} + C(65)\ \Delta EXP01_{t-3} + C(66)\ \Delta IMP_{t-1} + C(67)\ \Delta IMP_{t-2} + C(68)\ \Delta IMP_{t-3} + C(69) + \varepsilon_t$$

Hypothesis testing:

1. H_0 : There is no impact of IMPM on GDP c(51)=c(52)=c(53)=0
2. H_0 : There is no impact of FDI on GDP c(54)=c(55)=c(56)=0
3. H_0 : There is no impact of DI on GDP c(60)=c(61)=c(62)=0
4. H_0 : There is no impact of EXP01 on GDP c(63)=c(64)=c(65)=0
5. H_0 : There is no impact of IMP on GDP c(66)=c(67)=c(68)=0

Based on the granger Causality results and the results of the tested hypotheses in tables 5 and 6, it is observed that both FDI, domestic investment and import (exogenous construct) has a positive and significant association (p= 0.0008, 0.0557, and 0.0700) with the endogenous construct (economic growth), at 0.05, 0.10 and 0.05 level of significant respectively.

For clarity purpose the summary of the results from various models in terms of lead-lag linkages for Nigeria during the study period is shown in figure 1. FDI had a bidirectional significant influence on economic growth and also on import of other goods and services, which might

not be machinery and equipments. Apart from FDI, both imports and domestic investment impacted positively on economic growth in Nigeria during the study period. In addition, my analysis further revealed that, despite the positive impact of domestic investment on growth, FDI and trade, the reverse was the case for domestic investment.

This general lack of inducement for domestic investment might be due to inconsistent government policies, poor infrastructural development, political instability and low human capital development. The results of this study was similar to an earlier research by Akinlo (2004) on the impact of foreign direct investment (FDI) on economic growth in Nigeria, for the period 1970–2001; the ECM results of his work showed that, "lagged foreign capital have small, and not a statistically significant effect", on technology transfer (p. 627). The two results seem to support the argument that extractive FDI might not be technology or growth enhancing as much as manufacturing FDI (Akinlo, 2004). In a deviation from previous studies, my analysis failed to confirm a short-run causal relationship between FDI and technology transfer in Nigeria (Figure 1) during the study periods; also, I was unable to confirm whether technology transfers promote growth in Nigeria. This might be due to the low absorptive capacity and human capital development in Nigeria over the period (Heston et al., 2002; UNDP, 2007). Although, my results failed to establish that FDI play crucial role in mediating technology transfers into Nigeria, domestic investment and trade impacted positively on technology transfer.

Finally, all the variables in the Nigerian system were adjusting to equilibrium in the long run, with the exception of domestic investment (DI), which failed to do the adjustment in the long run.

CONCLUSION AND POLICY RECOMMENDATION

Conclusion

The aim of this study was to investigate the long-run equilibrium relationships among the international factors and economic growth, as well as, to assess the short-term impact of inward FDI, trade and domestic investment on economic growth in Nigeria. Since the variables in the Nigerian system were I(1), and may possess some kind of long run relationship, a multivariate cointegration technique developed by Johansen & Juselius (1990) was employed to investigate the long-run equilibrium relationships among the international factors and economic growth. The results of the multivariate cointegration analysis affirmed the existence of cointegrating vectors in the Nigeria systems; with four cointegrating vectors in the models. These results implied that, the variables in the Nigerian models had a long-run equilibrium relationship with one another and were adjusting in the short-run via four identified channels (Lee and Tan, 2006). Unfortunately, the existence of cointegrating vectors (cointegration) in the systems of this country only presumed the presence or absence of Granger-causality, it does not indicate the direction of causality between the variables; hence, the direction of the Granger-causality was detected through the vector error-correction model (VECM) derived from long-run cointegrating vectors (Granger, 1969; Lee and Tan, 2006). Hence, the Wald test Chi Square (at various significance levels of 1%, 5% and 10%), for the lag values of the independent variables indicated a short-run causal effect either running unidirectionally or bidirectionally between the variables for the country. For instance, similar to an earlier research by Akinlo (2004) on the impact of foreign direct investment (FDI) on economic growth in Nigeria: FDI had a bidirectional significant influence on economic growth. In addition, apart from FDI, both imports and domestic investment impacted positively on economic growth in Nigeria during the study period. Also, this study was unable to confirm whether technology transfers promote growth in Nigeria. Finally, all the variables in the Nigerian system were adjusting to equilibrium in the long run, with the exception of domestic investment (DI), which failed to do the adjustment in the long run.

Research implications for policy makers

In the light of the above findings, this research seeks to advise that, gains from trade and FDI differs within the study period. Policy makers should also know that, benefits from trade and FDI are not automatic, a certain level of infrastructures, education and human capital development, capacity building and consistent government's policies, are needed to maximize these benefits. The findings of this research suggest the need for Nigeria (and all developing countries) to formulate policies that will attract FDI in the service sector, so as to improve the infrastructural facilities, as a compliment to the resource and market seeking FDI from developed economies; labour force expansion and improved educational policy to raise the stock of human capital in the country is also recommended. Furthermore, since this study highlighted some of the benefits, linkages and relationship among FDI, trade, domestic investment and economic growth; this may give Nigerian policy makers in government agencies or trade representative's office some helpful facts to bring to the negotiating table (Adeoti and Adeoti, 2005). Due to the insignificant impact of FDI on domestic investment, Nigeria should, as a matter of urgency, diversify from primary-products induced to science and technology-induced FDI; the process technologies should also be upgraded through modernization of production facilities in the form of new plants and machinery (Okejiri, 2000). In general, the

results of this study should be adopted with care, the Wald tests Chi Square on VECM may be interpreted as within-sample causality tests since they indicate only the Granger-exogeneity of the dependent variable within the sample period; however, they do not provide information regarding the relative strength of the Granger-causal chain among the variables outside the sample period; this is hereby recommended as area of future research.

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