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Globalization, Economic Growth and Environmental Sustainability Nexus in Nigeria (1981-2013).

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Abstract: *Economic globalization has been lauded as a way of increasing World output based on the economies of scale property and exchange of technology, ideas and information. However, as more emphasis is put on the globalization of industry, the need for environmental sustainability–although as important as ever–is often not included in the conversation. This paper explored the contributions of trade liberalization and foreign direct investment inflows on growth in Nigeria and the implications of economic globalization on the Nigerian environment by applying the co-integration and Vector Error Correction Mechanism using data from 1981 to 2013 sourced from World Development Indicators (WDI) and Central Bank of Nigeria Statistical Bulletin. The findings indicated that trade openness and FDI inflows have made substantial contributions to economic growth in Nigeria. GDP and trade openness also aided environmental quality in the long run. FDI inflows on the other hand contributed to the worsening of the environment evident in more pollution emission in the long run. The paper recommends that Nigeria must put in place sound environmental policy to ameliorate the globalization effects on the environment particularly in FDI attractions. In addition, government and stakeholders alike must adhere to strict environmental enforcement to avoid excessive pollution discharges, indiscriminate deforestation, over exploitation of the flora, fauna and marine resources, and ill defined property rights among others. Government should realise effective macro-economic policies along with momentous improvements in the structure and functioning systems of governance for stabilising economic growth along with trade and financial liberalisation reforms.*

Keywords: *Globalization, Economic Growth, Environmental Sustainability, Trade Openness, Foreign Direct Investment, Co integration and Vector Error Correction Model*

I. Introduction

A key economic development of the last couple of decades has been the significant increase in the degree of economic globalization. Globalization has operated mostly through three channels: Trade in goods and services; capital mobility; and international policy cooperation. Reductions in trade barriers and the relaxation or elimination of capital controls have led to increases in trade and capital flows that have outpaced the rate of economic growth. The degree of trade (the share of international trade in GDP) and asset (the share of foreign assets in GDP) openness are much higher now in comparison to 25 years ago. Similarly, participation in international organizations (such as the WTO or the AU) has expanded. Globalization has implications for many important issues, ranging from living standards to the distribution of economic and political power. One such issue that occupies center stage at present in both the research and political agendas is the environment. All three channels described above are thought to matter for environmental quality (Vally & Bernauer, 2008; Arrow, Bolin, Costanza, Folke, Holling, Janson, Levin, Maler, Perrings, and Pimental, (1995).

Nigeria's trade policies over the years are short term in nature (fiscal yearly reviewed activities) but can be categorized under pre-SAP and post-SAP era. Generally it is aimed at securing balance of payments viability and export promotion. In the pre-SAP period, measures mostly adopted to check pressure on BOP include exchange control measures, import tariff, import licensing to effect the import substitution, industrialization policy, discriminatory custom tariff structure and, import prohibition. Trade policies during the SAP era was characterized by trade liberalization and the liberalization of the pricing system with emphasis on the use of appropriate price mechanism for foreign exchange allocation among others. The post SAP trade policies also liberalized imports by removing import licensing requirements and instead used customs tariff. The list of items under the prohibition list was drastically reduced (Analogbei, 2000 & Antweiler, 2001). All the above measures are aimed at promoting growth.

Recently, Nigeria and some other African countries have attained some level of liberalization. World Bank (2008) observed that in Sub-Saharan Africa, trade within the region and with the rest of the World increased from 52 percent of GDP to 72 percent, and gross private capital flows rose from 12 percent to 14 percent between 1990 and 2006. Nigeria also being a leading member of Economic Community of West African States with partial scope agreement, has achieved some stage of integration. It has also over the years attracted

substantial foreign direct investment. World Bank (2008) estimates put the net FDI inflow as percentage of GDP at 4.7 in 2006 and international tourists inbound at 1010 for the same period. It also estimated the financing through international capital markets gross inflows as percentage of GDP as one percent. However, the level of economic growth has not been too impressive. The issues at stake are: Does globalization through international trade and Foreign Direct Investment (FDI) inflows enhance growth of the economy? Does economic integration impact on the environment positively or negatively? Are there opportunities for Nigeria to sustain the environment in the face of globalization? The major objective of the study is to examine the impact of globalization through international trade, FDI, economic growth on environmental sustainability in Nigeria as well as suggesting ways of mitigating the impact of growth on the environment to guarantee sustainable development. Following the introduction is the theoretical considerations in section II. Section III examines globalization, output and environmental nexus in Nigeria. Section IV takes the methodology of the study while section V is the results and discussion of findings. Section VI is conclusion and recommendations.

II. Theoretical Considerations

Literature abounds on the impact of globalization on growth and the impact of globalization on the environment. According to the UNDP (2013), the South needs the North, and increasingly the North needs the South. The world is getting more connected. Recent years have seen a remarkable reorientation of global production, with much more destined for international trade, which, by 2011, accounted for nearly 60% of global output. Developing countries have played a big part: between 1980 and 2010, they increased their share of world merchandise trade from 25% to 47% and their share of world output from 33% to 45%. Developing regions have also been strengthening links with each other: between 1980 and 2011, South–South trade increased from less than 8% of world merchandise trade to more than 26%. The import of the UNDP's observation is that integration however conceived has some beneficial impact on growth. Heywood (1995) however sounds some cautions on the continuous growth of the global economy which he noted involves the consumption of many environmental services that constrains the production of goods and services and therefore may not promote sustainability.

Esty (1994) also submitted that globalization will increase the World output. However, there are prices to be paid for this expanded World output and the price to be paid is in form of deteriorating environmental conditions. Esty's observation may be valid especially in countries without sound intervention tools to ameliorate the effects of expanded output on the environment and developing countries are found culpable in this regard.

Vogel (1999) has explained that increased regional and international integration would not encourage nations, or sub-national governments to compete with one another by putting in place less stringent environmental regulations in what is termed as a "race to the bottom." The reasons stated why there not may be a race to the bottom includes the fact that for all but a handful of industries, the costs of compliance with stricter environmental standards have not been sufficient to force relatively rich nations or sub-national governments to choose between competitiveness and environmental protection. Secondly, while production standards clearly can and do affect corporate plant location decisions, for most countries the effects are not significant. Thirdly, just as industrial production often imposes public costs, so do protective regulations produce public benefits. The import of this is that economic integration may not necessarily lead to environmental degradation as popularly believed.

According to Vogel (1999) economic integration will not force a weakening of environmental standards, but in some cases, economic openness and capital mobility have been an impetus for nations to enact standards than they would have in the absence of increased interdependence. This they termed as "the race to the top." The reasons adduced to this include the fact that stricter domestic regulations can create market opportunities for the production and export of pollution control equipment. Secondly, stricter environmental regulations do not affect producers equally, so it can create advantages to some and disadvantages to others. To those that enjoy the benefits, this can create great avenue for domestic producers by making it more difficult for foreign producers to sell their products. To what extent the postulates of Vogel are correct in the developing countries' perspective in view of limited productive capacity and high consumption capability is another issue. There are some empirical literatures on the Impact of economic integration on growth and on the environment a review of these studies are provided below.

Kelvin (2004) examines the extent to which economic integration has affected Mexico's environmental degradation during the period 1985 to 2000. In his analysis, he drew from literature on two economic theories (environmental Kuznets curve (EKC) and the pollution haven hypothesis). In other words, EKC was used to illustrate the benefits Mexico would get by joining the North American Free Trade Agreement (NAFTA) while pollution haven was evoked by the opponents of free trade agreement who argued that free trade would automatically worsen environmental conditions in developing countries by encouraging a "race to the bottom". Kevin observed and concluded therefore that economic integration does not automatically improve or degrade

the environment as suggested by the EKC. He stated further that the purported pollution havens in Mexico either did not exacerbate the environmental condition but what triggered the environmental condition was what Kym Anderson and others have observed. That is, without proper environmental policies in place, economic integration can exacerbate existing market failures such as negative externalities. Kelvin based on his postulates above did not support or criticize the existence of EKC nor that of pollution haven, but observed that there are some conditions that could validate each of the hypothesis making the debate inconclusive.

Toshiyasu, Chan and Long Von (1998) analysed the implication of regional economic integration for Cambodia's sustainable development. Their research tries to seek answers on issue of growth with equity and poverty eradication, human resource development, agriculture and rural development, service and industrial sector development and the environment. They contented among other things that the Association of Southeast Asian Nations/ASEAN Free

Trade Area (ASEAN/AFTA) for Cambodian's environment needs research and policy actions by government. The first critical issue identified is the concern for pollution and toxic waste arising from the growth in industrial output occasioned by regional integration. The second is the issue of deforestation which is currently taking place at a high rate and, thirdly, the issue of rapid rate of urbanization with consequences in the form of traffic congestion, air pollution and waste collection. They therefore recommend the establishment of policy coherence and coordination within the Cambodian government as a success or failure factor in issues of regional integration in Cambodia. Their positions here is equally important as free trade areas are not automatic transformation tools without complementary intervention tools initiated to mop the aftermath effects.

Tosun and Knill (2009) investigated the interaction between economic integration and environmental policy by suggesting a theory-based disaggregation of the compound variable economic integration for deriving more precise expectations on its differential impact on environmental policy arrangements. Following the review of those related theoretical concepts relating to economic integration, they utilized data on environmental policy change in Turkey from 1975 to 2005 to evaluate the causal relationship between economic integration and environmental policy making in terms of sustainability. The two dependent variables examined are the changes in strictness of environmental policy measures regulating air pollution control and; actual air pollution through the emission of carbon-dioxide (CO2). One of their explanatory variables here is the economic integration and they utilized the x-centred research perspective (measuring partial effect) using correlation coefficient. They found that an increasing economic integration of the Turkish economy into global markets led to more stringent air pollution regulations.

Jorge and Cesar (2000) examined critically arguments for and against issues of incompatibility between expanded foreign trade and investment and the adherence to the environmentally sound pattern of economic development. They focused on the effects of expanded international trade and investment as it affects natural resources base on which economic activity takes place. The other focus is on the consequences of various environment patterns and legislations among countries based on trade and investment flows. They concluded that the experience with NAFTA suggests that for future integration, trade rules alone are not adequate to ensure environmental considerations, environmental rules are also essential and where such rules are already developed, new institutions must be initiated to ensure monitoring and enforcement.

Everett, Ishwaran, Ansaloni, & Rubin (2010) explored literature on economic impacts of environmental policy and concluded that environmental policy can be a strong driver of innovation. However the extent to which it confers growth benefits in the short run depend on a number of factors which include its extent of impact on input prices and; the economic quantification of environmental impacts. They also concluded that the natural environment is fundamental to the economy. What the above implies is that economic integration which has the potentials to boost growth is likely to have daring impact on the environment except policies are put in place to address this.

Zang and Eastin (2007) tested the theoretical postulates of the impact of international economic integration via trade and investment on environmental protection using China as a case study by using regional data spanning from 1996 to 2004 and statistical analysis. They concluded that openness to trade and foreign investment results in an overall improvement in environmental quality by encouraging superior regulatory standards and the development of environmental technology from China's key export markets. In addition, they also found that rather than leading regions to engage in the "race to the bottom" by lowering environmental standards, increased trade and investment stimulates more stringent policy enforcement and compliance. The results from previous researches in different countries give mixed and conflicting conclusions. In addition the extent this is correct in the Nigeria context is a debatable topic. Therefore the research seeks to contribute to the existing knowledge in the area of economic integration or globalization and the environment in Nigeria.

Viners (1950) custom union theory has always been the tool of theoretical exposition of the potential gains and losses of economic integration. The theory broke down these into the static or trade creation and trade diversion effects and the dynamic effects. The static effects are created due to resource allocation arising from changed in relative prices associated with changed pattern of tariffs. Dynamic effects refer to the benefits accruable due to

the creation of economies of scale that can trigger investment and growth arising from efficiency and big size. In Nigeria Ajide & Adeniyi (2010) assessed FDI, economic growth and environmental nexus in Nigeria using the ARDL bound testing approach. While the results establish a long run relationship between environment and foreign direct investment, the same cannot be said about foreign direct investment and economic growth which only depicts short run causal link between the two.

Generally, regional integration mostly lump together elements of free trade for members of the union or trade area and protectionism against non-members. Due to this reason, it has its associated benefits and costs. The extent of its benefits and costs depends of course on which of these elements predominates. However, the concept of trade creation indicates that removal of trade barriers within the free trade area can create greater trade and investment. This concept anchors on the principle of comparative advantage.

The dynamic effects creates what is known as the spillover effects arising from economies of scale from enlarged market and efficiency gains emanating from technology transfer and information gain. Others include increased inward FDI flows and the removal of trade barriers and a move away from contingent protectionism, cheaper goods and services due to economic cooperation and coordination.

Other benefits of economic integration includes but not limited to better terms of trade of members due to trade diversion, faster growth of economies, promotion of economic efficiency as a result of firm's competition. As can be seen from the foregoing, the general impact of economic interdependence is the promotion of economic growth which includes growth in output of goods and services of members. However, economic growth surely have some impacts on the environment. These impacts are in the form of externalities which may be beneficial or detrimental.

According to standard trade theory, trade in goods worsens environmental quality in countries that have a comparative advantage in the production of "polluting" goods. The comparative advantage may derive either from the distribution of the world endowments of the factors of production (the factor endowments theory, FET), in which case the developed or developing countries become dirtier with free trade due to their capital or resource abundance. Or, from policy related differences in tolerance of pollution (the pollution haven hypothesis, PHH), in which case the less developed countries are expected to become dirtier with international trade due to pollution haven effects. Nevertheless, static trade theory abstracts from an important determinant of environmental quality that is affected by international trade, namely income.

III. Methodology

Based on the literature reviewed and the theoretical framework, this section is preoccupied with the methodology of the research by formulation of models to capture the relationship between economic globalization FDI and Openness) and economic growth on one hand and economic globalization, economic growth and Environmental quality on the other hand.

The study used annual time series data from World Data Bank (African Development Indicators), Central Bank of Nigeria publications for the period 1980-2013.

The models are specified as:

GDP = F(FDI, OPN)……..(1)

C02= f(GDP, FDI, OPN)……..(2)

Where

GDP = Gross Domestic product

FDI = Foreign Direct Investment

OPN = Degree of Openness (Import + Export/GDP)

C02 = Carbon oxide Emission

In a more explicit form, the models can be written in a log-linear form to transform the variables into the same unit and base. Thus:

$InGDP = \alpha_0 + \alpha_1 InFDI + \alpha_2 InOPN + U_t$……..(3)

$InC0_2 = \beta_0 + \beta_1 InGDP + \beta_2 InFDI + In\beta_3 OPN + \varepsilon_t$……(4)

Where α_1 and $\alpha_2 > 0$, $\beta 1 > 0$ while $\beta 2, \beta 3 < 0$

From the equations above, the conditional VECM can be specified as:

$$\Delta \ln GDP_t = \theta_0 + \theta_1 \ln GDP_{t-1} + \theta_2 \ln FDI_{t-1} + \theta_3 \ln OPN_{t-1} + \sum_{i=1}^{p} \beta_{1i} \Delta \ln GDP_{t-i} + \sum_{j=1}^{q} \beta_{2j} \Delta \ln FDI_{t-j}$$

$$+ \sum_{k=1}^{r} \beta_{3k} \Delta \ln OPN_{t-k} + \rho ECM_{t-1} + \mu_t \quad \text{……..(5)}$$

$$\Delta \ln C02_t = \theta_0 + \theta_1 \ln C02_{t-1} + \theta_2 \ln GDP_{t-1} + \theta_3 \ln FDI_{t-1} + \theta_4 \ln OPN_{t-1} +$$

$$\sum_{i=1}^{p}\beta_{1i}\Delta\ln C02_{t-i}+\sum_{j=1}^{q}\beta_{2j}\Delta\ln GDP_{t-j}+\sum_{k=1}^{r}\beta_{3k}\Delta\ln FDI_{t-k}+\sum_{i=1}^{s}\beta_{4i}\Delta\ln OPN_{t-i}+$$

$$\rho ECM_{t-1}+\mu \ldots\ldots(6)$$

where

θ_i are the long run multipliers and β_0 is the drift, βi are the short run parameters, ECM is the error correction term that reconciles short run dynamics to the long run and μ_t is the error term.

3.1 Time Series Preliminary Tests

One major problem often associated with empirical analysis is non-stationarity of time series data. When variables being used for analysis are non-stationary, it usually leads to spurious regression results. In this case, the t-statistic, DW statistic as well as the R^2 values are not accurate.

In conducting the Dickey Fuller test, it is assumed that the error term εt is uncorrelated. But in case the εt is correlated, Dickey and Fuller have developed a test known as Augmented Dickey-Fuller (ADF) test. This test is conducted by :augmenting" the equation by adding the lagged values of the dependent variable $\Delta LOGC02_{t.i}$. Suppose, the equation for LOGC02 in our model, the ADF here consists of estimating the following:

$$\Delta LOGC02_t=\beta 0+\beta 1+\partial\Delta LOGC02t-1+\sum_{i=1}^{m}\lambda_1\Delta C02_{t-i}+\varepsilon t \ldots\ldots(7)$$

Where εt is a white noise error term and $\Delta C02_{t-1}$ = ($\Delta C02_{t-1}$ - $\Delta C02_{t-2}$) etc. The number of lagged difference terms to include is often determined empirically, the idea being to include enough terms so that the error term in (7) is serially uncorrelated. In ADF we test whether $\partial = 0$ and the ADF follows the asymptotic distributions and some critical values can be used.

For this reason, the Augmented Dickey-Fuller (ADF) test was used to test the stationary status of the variables used in the growth equation. The presence of unit root in the series indicates that the variable is non-stationary, hence the degree or order of integration is one or higher. The absence of unit root however, implies that the variables are stationary and the order of integration is zero.

To investigate the presence of random walk in the time-series data, a unit-root test is carried out. This is to ascertain the stationary nature of the data to avoid a spurious regression model.

3.2 Granger Causality Test

Although regression analysis deals with the dependence of one variable on the other variables, it does not necessarily imply causation. In other words, the existence of a relationship between variables does not prove causality or this direction of influence. But in regression involving time series data, the situation may be somewhat different because, one author puts it,

"… time does not run backward. That is, if event A happens before event B, then it is possible that A is causing B. however, it is not possible that B is causing A. in other words, events in the past can cause events happen today…". Further events cannot (Gujarati and Sangeetha, 2007). This is roughly the idea behind the so-called granger causality test.

To explain the granger causality test, consider the LC02 equation a function of LOGGDP. This question is often asked in macroeconomics. Is it LOGGDP that "causes" the LOGC02 (LOGGDP→ LOGC02) or is it LOGC02 that causes LOGGDP (LC02→ LOGGDP), where the arrow points to the direction of causality. The granger causality test assumes that the information relevant to the prediction of the respective variables, LOGC02 and LOGGDP, is contained solely in the time series data in these variables. The test involves estimating the following pair of regressors:

$$LOGC02_t=\sum_{i=1}^{n}\alpha_1 LOGGDP_{t-i}+\sum_{i=1}^{n}\beta_1 LOGC02_{t-j}+\mu_{1t} \ldots\ldots(8)$$

$$LOGGDP_t=\sum_{i=1}^{n}\lambda_1 LOGGDP_{t-i}+\sum_{i=1}^{n}\delta_1 LOGC02_{t-j}+\mu_{2t} \ldots\ldots(9)$$

Where it s assumed that the disturbances μ_{1t} and μ_{2t} are uncorrelated. In passing, note that since we have two variables, we are dealing with bilateral causality. However, since we are dealing with bilateral causality, we can apply the technique of vector auto regression (VAR).

Equation (8) postulates that current LOGC02 is related to past values of itself as well as that of LOGGDP, and (9) postulates similar behavior for LOGGDP. We now distinguish four cases:

(1) Unidirectional causality from LOGGDP to LC02 is indicated if the estimated coefficients on the lagged LOGC02 in (8) are statistically different from zero as a group (i.e., $\sum \alpha i \neq 0$) and the set of estimated coefficients on the lagged LOGGDP in (9) is not statistically different from zero (i.e., $\sum \partial j = 0$).
(2) Conversely, unidirectional causality from LOGC02 to LOGDP exists if the set of lagged LOGGDP coefficients in (6) is not statistically different from zero (i.e., $\sum \alpha i = 0$) and the set of the lagged LOGCO2 coefficients in (7) is statistically different from zero (i.e., $\sum \partial I \neq 0$).
(3) Feedback, or bilateral causality, is suggested when the sets of LOGGDP and LOGC02 coefficients are statistically significantly different from zero in both regressions.
(4) Finally, independence is suggested when the sets of LOGGDP and LOGC02 coefficients are not statistically significant in both the regression.

3.3 Johansen Co integration Test and Long Run Dynamics

According to Johansen (1991), co integration can be used to establish whether there exists a linear long-term economic relationship among variables. In this regard, Johansen (1991) asserts that co integration allows us to specify a process of dynamic adjustment among the co integrated variables and in disequilibrated markets. Given that the series are I(1), the co integration of the series is a necessary condition for the existence of a long run relationship. The co integration results of both the trace and Maximum-Eigen value statistic of the Johansen co integration test are presented and displayed in table 5 and 6.

IV. Results And Discussion

4.1 Time Series Preliminary Unit Root Test

Table 1: Augmented Dickey Fuller Unit Root Test

ADF AT	LEVELS			ADF AT	FIRST	DIFF.	
Variable	ADF-Stat	OI Lag	Prob**	ADF-Stat	OI Lag	Prob**	Included
LOGGDP	-0.1028	I(0) [7]	0.9918	-5.3353	I(1) [6]	0.0012*	Tren/Interc
LOGC02	-0.4988	I(0) [1]	0.8784	-11.0930	I(1) [0]	0.0000*	Intercept
LOGFDI	-2.1466	I(0) [0]	0.5016	-4.6727	I(1) [2]	0.0043*	Tren/Interc
LOGOPN	-1.9254	I(0) [0]	0.6157	-5.4329	I(1) [0]	0.0007*	Tren/Interc

Note: *, **, *** indicate significance at 1%, 5% 10% level.
Source: Computing Using Eviews 7.0 Econometric Package

From the results of unit root test in table 1, the null hypothesis of unit root for all the variables cannot be rejected at levels. This means that all the variables are not stationary at levels since their p-values are not significant at all conventional levels of significant. LOGGDP, LOGFDI and LOGOPN included both trend and intercept in the test while LOGC02 included only intercept. This shows that the series are non-stationary at levels but became stationary at first difference. This further implies that although the series are individually non-stationary, a linear combination of these series is stationary, hence co integrated.

Table 2: PP Unit Root TES Results

PP AT	LEVELS			PP AT	FIRST	DIFF.	
Variable	PP-Stat	OI BW	Prob**	PP-Stat	OI BW	Prob**	Included
LOGGDP	-1.9789	I(0) [3]	0.5880	-5.4774	I(1) [6]	0.0007*	Tren/Interc
LOGC02	-1.1070	I(0) [1]	0.9967	-5.2008	I(1) [1]	0.0002*	Intercept
LOGFDI	-1.0734	I(0) [6]	0.7140	-11.0221	I(1) [1]	0.0000*	Intercept
LOGOPN	-1.9185	I(0) [7]	0.6217	-7.3318	I(1) [3]	0.0000*	Tren/Interc

Note: *, **, *** indicate significance at 1%, 5% 10% level.
Source: Computing Using Eviews 7.0 Econometric Package

The PP unit root test in table 2 indicates that the series are non-stationary at levels but became stationary at first difference. This is an indication that the variables are all integrated of order one I(1), hence co integrated.
Table and 1 and 2 however show that at first difference all the variables are stationary and we reject the null hypothesis of the existence of unit root. We reject the null hypothesis of the existence of unit root in D(LOGCO2), D(LOGGDP), D(LOGFDI) and D(LOGOPN) at the 1% level of significance. From the above analysis, one can therefore conclude that all variables are integrated of order one I(1) and in order to avoid spurious regression, the first difference of all the variables must be employed in the estimation of the short run equation.

4.2 Lag Section criteria

Table 3: Akaike Information Criterion/ Schwarz Criterion

Lag	LogL	LR	FPE	AIC	SC	HQ
0	-62.1604	NA	0.001326	4.72575	4.78393	4.91606
1	3.79767	131.92	0.000038	1.15731	1.44822	2.10888
2	33.8642	60.133*	0.000015*	0.152554*	0.672554*	1.86539*

Note: indicate indicates lag order selected by the criteria.
LR: Sequential modified likelihood ratio (LR) test statistic (each test at 5% level)
FPE: Final Prediction Error
AIC: Akaike information Criterion
SC: Schwarz Criterion
HQ: Hannan Quinn Criterion
Source: Computing Using Eviews 7.0 Econometric Package

The selection criteria result shows that the whole criteria selected lag 2. The likelihood ratio, the final prediction error, the Akaike information, the Schwarz and Hannan criteria selected lag 2 as shown by the asterisk at 0.05 significance level.

4.3 Co integration Test

Table 4: Johansen Co integration (Trace) Test

Hypothesized No. of CE(s0	Eigen-Value	Trace-statistic	0.05 Critical Value	Prob.
None*	0.641811	54.59578	47.85613	0.0102
At most 1	0.518121	26.87508	29.79707	0.1047
At most 2	0.227641	7.163358	15.49471	0.5588
At most 3	0.006979	0.189087	3.841466	0.6637

Trace test indicates 1 Co integrating Equation(s) at the 0.05 level
* denotes rejection of the hypothesis at the 0.05 level
Source: Computing Using Eviews 7.0 Econometric Package

Table 5: Johansen Co integration (Maximum Eigen-Value) Test

Hypothesized No. of CE(s0	Eigen-Value	Max. Eigen-statistic	0.05 Critical Value	Prob.
None*	0.641811	27.72072	27.58434	0.0102
At most 1	0.518121	19.71170	21.13162	0.1047
At most 2	0.227641	6.974271	14.26460	0.5588
At most 3	0.006979	0.189087	3.841466	0.6637

Maximum Eigen-Value test indicates 1 Co integrating Equation(s) at the 0.05 level
* denotes rejection of the hypothesis at the 0.05 level
Source: Computing Using Eviews 7.0 Econometric Package

It can be seen from both table 4 and 5 that the trace statistic and the maximum Eigen value statistic indicate the presence of one co integration among the variables. This confirms the existence of a stable long-run relationship among LOGC02 as the dependent variable, LOGGDP, LOGFDI and LOGOPN as the independent variables. Also a steady relationship exists between LOGGDP as dependent variable, LOGFDI and LOG OPN as the independent variables of the other equation.
Base on the indication of one co integrating vector among the variables, the estimated long-run equilibrium relationship for LOGC02 was derived from the normalised vectors as presented in the appendix.
The first vector appears to be the one which we can normalise LOGC02 vectors from the un-normalised co integrating coefficients in table 6.

4.4 Matrix of Coefficients and Long Run Estimates

Table 6: Matrix of Co integrating Normalized Coefficients

LOGC02	LOGGDP	LOGFDI	LOGOPN
-6.707441	4.902718	-3.439327	2.907782
3.321962	0.468017	-0.749928	5.889455
-2.760944	-1.335250	3.124494	-4.145812
-1.499419	1.982722	0.254126	-3.203104

Source: Computing Using Eviews 7.0 Econometric Package

Table 7: Normalised Cointegrating Coefficients : LOGC02 = β_0 + β_1LOGGDP + β_2LOGFDI + β_3LOGOPN

Variable	Coefficient	Std Error	t-statistic	Prob.
LOGGDP	-0.730937	0.10719	-6.81926	0.0000*
LOGFDI	0.512763	0.12137	4.22484	0.0000*
LOGOPN	-0.433516	0.22037	-1.96722	0.0490**

R-squared = 0.4849 AIC = 3.898879 SC = 5.205364 HQ = 4.275099 RMSE = 0.743086
, * indicate significance at 1% and 5% level respectively
Source: Computing Using Eviews 7.0 Econometric Package

The choice of this vector is based on the sign expectations about the long-run relationships as indicated in equation below.
The long-run relationship was derived by normalising LOGCO2 and dividing each of the co integrating coefficients by the coefficient of LOGC02. The long run relationship is specified as:

LOGC02 = -4.1979 - 0.7309LOGGDP + 0.5128LOGFDI - 0.4335LOGOPN.....(10)

The model of equation (10) above represents the long-run effects on LOGC02. Firstly, the constant exerts a negative effect on LOGC02. This implies that holding all the independent variables at zero, LOGC02 level decreases by 4.1979.
Gross Domestic Product (LOGGDP) exerts negative effects on C02 emission, which implies that as GDP increases in the long run,C02 emission level also decreases. The finding is in line with the discredited famous Environmental Kuznets Curve (EKC). The coefficient of -0.7309 implies that in the long run, a 100 percent increase in GDP will lead to approximately 7.3 percent decrease in C02 emission. This is assumed to be true according to the EKC when awareness must have been created and new technology are put in place to enhance cleaner technological production. As income (GDP) increases, reach a certain point called the threshold, environmental pollution decreases with further increase in income (GDP).
Foreign direct investment (LOGFDI) is found to possess positive sign and statistically significant. This implies that increase in globalization through FDI would lead to increase in environmental degradation. The findings is also in line with the work of Riti etal (2015) and with the famous Pollution Haven Hypothesis (PHH) where developing countries adopt trade liberalization (less stringent environmental regulations) to attract FDI for growth. However, the inflows of FDI lives with it some environmental problems. A 100 percent increase in FDI inflows would lead to a 1.9 decrease in environmental quality.
Openness a proxy for trade however is found to be negative and also statistically significant in the long run. This shows that openness of the economy does not harm the environment in Nigeria for the period under review. The coefficient of -0.4335 implies that in the long run, a 100 percent increase in openness via trade will lead to approximately 4.3. percent increase in C02.

Table 8: Normalised Cointegrating Coefficients : LOGGDP = α_0 + α_1LOGFDI + α_2LOGOPN

Variable	Coefficient	Std Error	t-statistic	Prob.
LOGFDI	0.190029	0.31981	0.59420	0.5520
LOGOPN	2.608688	0.83759	3.11450	0.0020**

R-squared = 0.25438 F-stat = 3.57578 AIC =1.669047 SC = 2.930125 RMSE = 0.264214
, * indicate significance at 1% and 5% level respectively
Source: Computing Using Eviews 7.0 Econometric Package

In addition the long-run relationship of LOGGDP was derived by normalising and dividing each of the co integrating coefficient by the coefficient of LOGGDP in table 8. The steady relationship is specified as:

LOGGDP = -26. 9957 + 0.19000LOGFDI + 2.6087LOGOPN.....(11)

The model of equation (11) shows LOGGDP depending on the globalization (trade proxied by degree of openness and FDI). The model indicates that in the long-run both FDI and openness contribute positively to GDP. This findings is in tandem with the findings of , De Mello (1997). A 100 percent change in FDI inflows and openness will lead to 19 and 261 percent change in GDP in the positive direction all things being equal. No wonder the need to develop and expectations from the beneficial impacts of FDI which constitutes one of the key outcomes of globalization process in the developing nations actually propel many of the African countries to support and promote liberalization policies in their various countries.

4.5 Unit Root Test of Residuals

Table 9: Testing for the Stationarity of the Residuals

Variable	None	Constant	Constant & Trend	Conclusion
Residuals/	t-obs	t-obs	t-obs	OI Lag
Error term	-5.9310(0.0000)	-7.5603(0.0000)	-5.3480(0.0012)	I(1) [1]

Source: Computing Using Eviews 7.0 Econometric Package

The stationarity of the residuals obtained from the co integration regression of the dependent variables (LOGC02 and LOGGDP) of the two equations on the independent variables has been tested using the ADF test. The result shown in table 9 revealed that the residual is stationary at first difference of 0.01 significance level. The test included none, intercept, trend and intercept.

4.6 Short Run Estimates and Parsimonious Error Correction Mechanism

Table 9: Short Run Dynamic and Error Correction Model of C02=f(GDP,FDI,OPN)

Variable	Coefficient	Standard Error	t-statistic	Probability
D(LOGC02(-1))	-0.170802	0.14664	-1.16474	0.2440
D(LOGC02(-2))	0.460480	0.18699	2.46256	0.0140*
D(LOGGDP(-1))	0.278542	0.14121	1.97257	0.0490**
D(LOGGDP(-2))	0.004027	0.12156	0.03313	0.9740
D(LOGFDI(-1))	-0.002648	0.11906	-0.02224	0.9820
D(LOGFDI(-2))	-0.128409	0.09081	-1.41397	0.1570
D(LOGOPN(-1))	-0.215597	0.15965	-1.35041	0.1770
D(LOGOPN(-2))	-0.152381	0.13007	-1.17153	0.2410
C	0.011292	0.03132	0.36057	0.9084
ECM(-1)	-0.487241	0.16836	-2.89399	0.0040**

R-squared = 0.743 F-statistic = 5.463629 DW = 1.666006 Prob. = 0.0000
Adj. R-squared = 0.607088 AIC = 0.417347 SC = 2.529081
, * indicate significance at 1%, 5% and 10% level respectively
Source: Computing Using Eviews 7.0 Econometric Package

The short run dynamics among the variables are explored by employing vector error correction model (VECM). Error correction model allows the introduction of previous disequilibrium as independent variables in the dynamic behavior of existing variables. Table 9 presents the short run dynamic relationship and the set of short run coefficients in the vector error correction model. VECM associates the changes in C02 to the change with the other lagged variables and the disturbance term of the lagged periods. The coefficient of the speed of adjustment is negative and significant at 5 percent. This shows that there is 48.7 percent point adjustment taking place each year towards the long run periods. From table 9, the past two years of C02 emission impact negatively and positively on current C02 respectively, however, it is the previous two year's record that is significant. Considering GDP, the immediate past record of GDP in the previous two years had a positive impact in the short run, however, they are all not significant. Finally, both past record of FDI and openness had negative impacts on C02 and are not statistically significant. Therefore, in the short run, the relation between the past two year of C02, past one year of GDP and current C02 are inelastic and statistically significant in explaining the variation in environmental pollution (C02 emission).

Table 10: Short Run Dynamic and Error Correction Model of GDP=f(FDI,OPN)

Variable	Coefficient	Standard Error	t-statistic	Probability
D(LOGGDP(-1))	-0.185346	0.22714	-0.81601	0.4140
D(LOGGDP(-2))	-0.026179	0.26947	-0.09715	0.9230
D(LOGFDI(-1))	0.027245	0.12407	0.21960	0.8260
D(LOGFDI(-2))	0.079013	0.11657	0.67784	0.4980
D(LOGOPN(-1))	-0.136303	0.24872	-0.84801	0.5840
D(LOGOPN(-2))	-0.212167	0.22877	-1.92741	0.3540
C	0.063510	0.06056	1.59107	0.1510
ECM(-1)	-0.060216	0.02769	-2.26254	0.0440**

R-squared = 0.154837 F-statistic = 0.575780 DW = 1.900329 Prob. = 0.0000
Adj. R-squared = -0.114078 AIC = 1.669047 SC = 2.930125
, * indicate significance at 1%, 5% and 10% level respectively
Source: Computing Using Eviews 7.0 Econometric Package

Table 10 shows that the previous values of GDP and openness exert negative influence on the current value of GDP. While the pas records of FDI exert positive effects on GDP. This shows that globalization through

movement of capital (FDI) contribute positively to economic growth while trade proxied by openness does not for the period under review.

4.7 Evaluation of the Model

Table 11: Diagnostic Test

Diagnostic	Statistic	Conclusion
Ramsey Rest Test	F–statistic = 1.9519 (0.0627) Log-likelihood=3.8101(0.0687)	Equation is correctly specified
ARCH Test	F–statistic = 0.2965 (0.5907) Obs*R-squared = 0.3157(0.5742)	There is no ARCH element in the residual
Breusch-Godfrey-Serial correlation LM Test	F–statistic= 1.6126 (0.2211) Obs*R-squared = 3.5664 (0.1681)	No serial correlation
Multivariate Normality	Jack-Bera test = 1.9268 p-value = 0.3816	Residuals are normal

Source: Author's Computation using Eviews 7.0 Econometric Package

The result of the diagnostic test in table 11shows that the model is correctly specified, has no ARCH element in the residual, no serial correlation and the residuals are normal. That is the model suffers no any aforementioned econometric problem.

Figure 1: Stability Test of Residuals

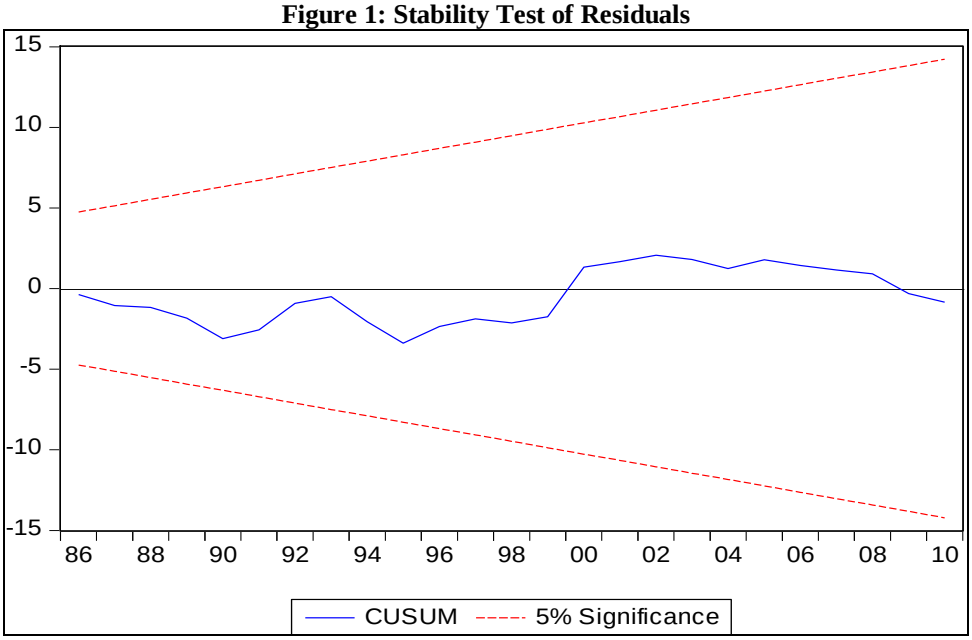

Figure 1 above shows the stability of the model of LOGC02. The figure indicates that the model has been stable since no root lie outside the range of the conditions. The CUSUM residual test satisfies the stability test at 5% significance level.

4.8 Granger Causality Test

Table 12: Result of Granger Causality Test

Null Hypothesis	F-statistic	Probability	Decision	Direction
LGDP does not granger cause LC02 LC02 does not granger cause LGDP	1.16216 2.93983	0.3305 0.0730	Accept Accept	LGDP⇿LC02
LFDI does not granger cause LC02 LC02 does not granger cause LFDI	0.26006 4.25064	0.7732 0.0269	Accept Reject	LC02→LFDI
LOPN does not granger cause LC02 LC02 does not granger cause LOPN	0.87442 1.99338	0.4305 0.1591	Accept Accept	LOPN⇿LC02
LFDI does not granger cause LGDP LGDP does not granger cause LFDI	5.11434 0.06026	0.0134 0.9416	Reject Accept	LFDI →LGDP
LOPN does not granger cause LGDP LGDP does not granger cause LOPN	0.78090 7.50819	0.4684 0.0027	Accept Reject	LGDP→OPN

Source: Author's Computation using Eviews 7.0 Package

The results of granger causality test in table 11 shows that there s a unidirectional causality between LC02 and LFDI running from LC02 to LFDI. Also, a unidirectional causality exists between FDI to GDP and GDP to

OPN. While LGDP and LC02, LOPN and LC02 show independence.

V. Conclusion

Based on the above results, we can conclude that C02 emission (a measure of environmental pollution) is positively linked with previous C02 and economic growth (output) but negatively related to foreign direct investment and trade openness in the short run. Generally, only previous C02 and GDP significantly explained pollution in the short run while FDI and trade openness show no significance in the short run. In the long run, FDI inflow, GDP and trade openness significantly explained pollution. GDP and trade openness significantly decrease pollution in Nigeria. This line of arguments support the discredited EKC hypothesis. The FDI result is a clear confirmation of the reality pollution haven hypothesis in Nigeria. Trade openness however is beneficial to the environment as revealed by the negative relationship between pollution and trade openness. This is in agreement with the postulates that trade promotes efficiency and better use of country's endowment including the environment. Trade also enhances income growth which leads to higher living standards and encourages the stronger demand for the environment.

On the growth model both FDI and trade openness exert positive impact on economic growth (GDP) in the long run though only trade openness is statistically significant at 5 percent. The reason for the insignificant contribution of FDI to growth may be linked with the absence of or inadequate provision of infrastructure in the Nigerian economy.

On the basis of the above we can conclude that trade openness is beneficial to growth and the environment in Nigeria. Foreign direct investment inflow has not been able to be harnessed in Nigeria to act as a stimulator of growth and environmental improvement.

Based on our findings, globalization suggests that government of Developing countries like Nigeria must put in place sound environmental policy to ameliorate the integration effects on the environment. In addition, they must adhere to strict environmental enforcement to avoid excessive pollution discharges, indiscriminate deforestation, over exploitation of the flora, fauna and marine resources, and ill defined property rights among others. Nigeria must intensify their natural resource-based activities so as to avoid irreversible damage especially to their non-renewable natural resources and should manage their renewable natural resources so that the rate of harvest must not outgrow the regenerative capacity of those resources. Finally though trade openness and growth significantly reduce environmental pollution in the long run and increase economic growth, government should realise effective macro-economic policies along with momentous improvements in the structure and functioning systems of governance for stabilising economic growth along with trade and financial liberalisation reforms. The focus of this paper has been on investigating the relationship between globalization, economic growth and environmental sustainability nexus in Nigeria. There are however few other areas of research in the literature for the country. Given the peculiarity of the Nigerian economy characterized by deplete-able resources, an examination of the economic integration and resources depletion should also be considered.

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Appendix

Unrestricted Cointegrating Coefficients (normalized by b'*S11*b=I):				
LOGGDP	LOGFDI	LOGOPN		
0.988717	0.187885	2.579253		
-2.923230	3.255726	-3.896311		
0.601945	0.466683	-3.216671		

Unrestricted Cointegrating Coefficients (normalized by b'*S11*b=I):				
LOGC02	LOGGDP	LOGFDI	LOGOPN	
-6.707441	4.902718	-3.439327	2.907782	
3.321962	0.468017	-0.749928	5.889455	
-2.760944	-1.335250	3.124494	-4.145812	
-1.499419	1.982722	0.254126	-3.203104	

Figure 1: Stability Test of Residuals

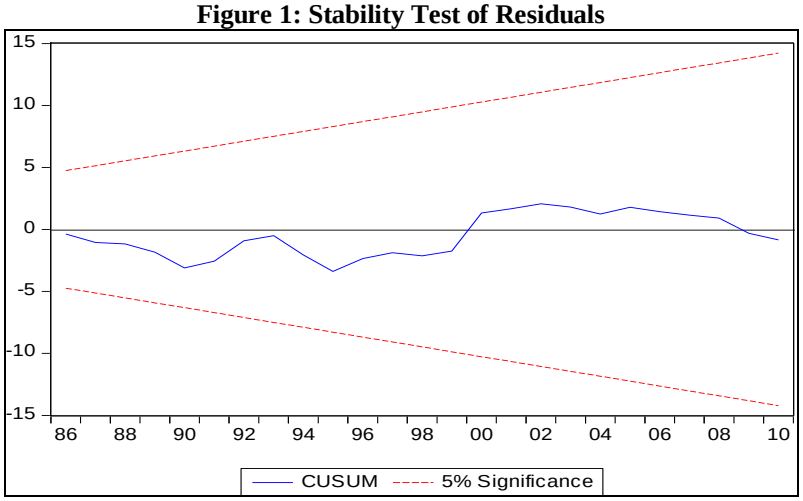

Table of Data for Analysis

LOGC02	LOGFDI	LOGSER	LOGGDP	LOGOPN
11.09678	20.11138	23.59798	24.83539	-0.72788
11.09137	19.88072	23.43817	24.66285	-0.97422
11.00093	19.71386	23.11495	24.29143	-1.30796
11.15088	19.05813	22.85006	24.0732	-1.44355
11.15472	20.00086	22.83315	24.08621	-1.35092
11.20511	19.07931	22.55077	23.75444	-1.43899
10.99109	20.22987	22.55028	23.9052	-0.87595
11.16687	19.75217	22.48317	23.87052	-1.04095
10.65589	21.3568	22.44166	23.91091	-0.50432
10.72273	20.19204	22.63758	24.14939	-0.63431
10.71989	20.38411	22.51186	24.03355	-0.43268
11.08035	20.61417	22.4362	24.10088	-0.49379
11.00313	21.01993	21.98583	23.48258	-0.54284
10.75062	21.39581	22.30766	23.61843	-0.86017

10.46073	20.79955	22.51895	24.07482	-0.5147
10.60711	21.18917	22.65114	24.27827	-0.55007
10.60138	21.15469	22.74333	24.30184	-0.26318
10.6012	20.77332	22.85516	24.18915	-0.41289
10.70971	20.72817	22.9514	24.30319	-0.58257
11.2795	20.85441	23.00612	24.56026	-0.33715
11.33081	20.89775	23.10087	24.51059	-0.20074
11.494	21.35136	23.20738	24.80278	-0.45596
11.44184	21.4191	23.32535	24.9377	-0.28477
11.48295	21.35136	23.73636	25.19884	-0.72468
11.55882	22.3292	23.9947	25.44398	-0.67829
11.49795	22.30315	24.35133	25.70296	-0.43681
11.46384	22.52084	24.50134	25.83797	-0.43908
11.43627	22.82699	24.68609	26.06112	-0.4312
11.18051	22.86976	24.59163	25.85601	-0.48122
11.27607	22.52309	26.00381	26.63423	-0.85211
NA	22.90277	26.09532	26.74367	-0.63877
NA	22.68351	26.23756	26.86095	-0.81238
NA	22.44764	26.40724	26.98056	-1.17035