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FDI and the Environment in Developing Economies: Evidence from Nigeria

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Abstract: The study conducts an investigation on the causal relationship among FDI, economic growth and environment using the Autoregressive Distributed Lag (ARDL) approach. Annual time series data is employed for the period spanning 1970-2006. The results which emanated from the findings depict that there was none existence of a long run relationship between FDI and growth on the one hand while there exists a long run causal link between CO_2 per capita (a measure of environmental quality) and FDI inflows on the other hand. The policy lessons from these findings are that any policy that will aim at attracting foreign direct investment inflow should be one that will encourage and promote the adoption of cleaner production technologies.

Key words: FDI, economic growth, environment, ARDL model, encourage, investment

INTRODUCTION

One of the ultimate desires of every economy is to achieve sustainable economic growth and development. However, the means through which this objective can be achieved are multidimensional. Empirical studies from both cross country and country specific experiences have pointed to Foreign Direct Investment (FDI hereafter) as being critical in promoting growth. For instance, De Mello (1997) outlines two main channels through which FDI may be growth enhancing: First, FDI can encourage the adoption of new technology in the production process through capital spillovers. Second, FDI may stimulate knowledge transfers, both in terms of labour training and skill acquisition and by introducing alternative management practices and better organizational arrangements.

Apart from the above submissions, FDI is also expected to bridge the internal resource and savings gap, increase managerial abilities, reduce foreign exchange shortage and improve balance of payments in less developed countries. The foregoing not withstanding, there appears to be no general agreement among researchers on the association between FDI inflows and economic growth. While some studies observe a positive impact of FDI on economic growth, others detect a negative relationship between these two variables Aitken and Harrison (1999), Djankov and Hoekman (1999), Damijan *et al.* (2001), Konings (2000), Castellani and Zanfei (2002a, b) and Zukowska-Gagelmann (2002) for evidences from both sides of the debate).

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. Hence, the adoption of the structural adjustment programmes in the 1980s by these developing African countries. But adopting liberalisation policies and allowing for free movement of capital, particularly long term capital such as FDI could embody some adverse environmental consequences. Some view environmental quality as a normal good and hence opine that free trade and the resulting economic growth would lead to cleaner environment. This line of argument forms the root of the famous Environmental Kuznets Curve (EKC).

Despite the barrage of critique that trail the importance of FDI, it is interesting to note that Nigeria still sees FDI as an avenue through which growth-enhancing performances may be permeated to the entire economy. The adoption of the structural adjustment programme in 1986 actually created an impetus for the inflows of FDI into the country unlike the pre 1986 era that was characterized by restrictive policy measures like Nigerian Enterprise Promotion Decree (NEPD) and other Indigenization Decrees. Thus, Nigeria is one of the few countries that have consistently benefited from the FDI inflows to Africa. Nigeria's share of FDI inflows to Africa varied from around 24.19% in 1990 to a low level of 5.88% in 2001 and almost doubled at 11.65% in 2002 (Ayanwale, 2007). UNCTAD (2003) showed Nigeria as the continent's second top FDI recipient after Angola in 2001 and 2002. The UNCTAD World Investment Report shows that FDI inflow to West Africa is mainly dominated by inflow to Nigeria who received 70% of the sub-regional total and

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11% of Africa's total. Out of this Nigeria's oil sector alone receive 90% of the FDI inflow. It is against this background that the study is interested in unravelling the causal link between FDI and growth on the one hand and environmental impact of FDI on the other hand. It is therefore natural then to ask whether and to what extent the upsurge in FDI inflows may have caused or contributed to increased growth rates.

FDI and the environment in Nigeria (Some Stylized Facts): Not so much FDI has been attracted into the African continent, except for a few countries for reasons such as: negative image of the region, bad governance, large scale corruption and corrupt practices, foreign exchange shortages and an unfriendly macroeconomic policy environment, among others. Of a few African countries that have benefited from FDI inflows, Nigeria was ranked as the second top FDI recipient after Angola in 2001 and 2002 (UNCTAD, 2003).

From Table 1, it is evident that Nigeria has consistently benefited from the FDI inflows into Africa as her share of FDI inflows to Africa averaged around 10% between 1980 and 2003. Table 2 also shows Nigeria's FDI both in nominal and real terms. From the Table 2, it is observed that nominal FDI inflows into Nigeria which stood at N128.6 million in 1970 rose to N253.0 in 1975 but fell precipitously to a negative value of N-404.1 in 1980. This value later rose substantially to N75, 940.6 in 1995 before peaking at N225, 036.5 in 2002.

Correspondingly, there was an increase in FDI in real terms from N1190.70 in 1970 to N1222.20 in 1975 and decline in the mid-1980s to a negative value of N-955.32. FDI forms a small percentage of the nation's Gross Domestic Product (GDP). However, its share of 2.47,-0.81, 2.39 and 3.93% in 1970, 1980, 2000 and 2002, respectively is far from trivial.

The downward trend of FDI inflows can be, in part, explained by the world oil price crash in 1980s. This later led to a massive divestment from the nation and the subsequent low level of inflow obtained until 1986. Some other government policies also discouraged FDI inflows into the country. Example of such policies include: Companies Tax Act, 1961; Exchange Control Act, 1962 and Immigration Act 1963. The gradual increase of FDI was occasioned by the adoption of SAP in the late 1980s during the Babangida-led administration. The then policy measures which aimed at encouraging FDI inflows include: the inauguration of the Industrial Development Coordination Committee (IDCC), the Companies and Allied Matters Decree 1990, financial liberalization and the debt-equity swap programmes.

Table 1: Net foreign direct investment inflows (US$ Million)

Years	Nigeria	Africa	Percent of Africa
1980	-188.52	392	-
1990	588.00	2430	24.19
1995	1079.00	5119	21.07
1997	1539.00	10667	14.43
1998	1051.00	8928	11.77
1999	1005.00	12231	8.22
2000	930.00	8489	10.96
2001	1104.00	18769	5.88
2002	1281.00	10998	11.65
2003	1200.00	15033	7.98

Ayanwale, 2007

Table 2: Nigeria's foreign direct investment, 1970-2002

Years	Nominal FDI (Nmillion)	FDI (percentage of GDP)	Real FDI (Nmillion)
1970	128.6	2.47	1190.70
1975	253.0	1.21	1222.20
1980	-404.1	-0.81	-955.32
1985	434.1	0.60	434.10
1990	4686.0	1.81	1598.23
1995	75940.6	3.87	3721.85
2000	115952.2	2.39	2955.09
2001	132433.7	2.39	3102.90
2002	225036.5	3.93	4368.37

Central Bank of Nigeria (CBN) Statistical Bulletin

The Table 3 shows anecdotal evidence on the growth-environment nexus in Nigeria. It is clear that the average annual growth of per capita CO_2 fell precipitously from 0.84 tons from 1980-1989 to 0.41 tons in the period spanning 2000-2008.

This result is not surprising given the rate of decline in the share of the manufacturing sector in total GDP which took a downward turn from 8.186 from 1980-1989 to 4.104 from 2000-2008. In terms of the relationship between per capita CO_2 emissions and GDP per capita, an inverse pattern appears to emerge in the movement of these variables suggesting that as GDP per capita increases, per capita emission falls over the period 1980-2008. Also, though not a part of our investigations core, the financial development variables like the ratio of traded stock to GDP and FDI increased substantially over the same period.

For instance, between 1980 and 1989 the value of FDI which stood at US$4426 rose to US$41023.39 between 2000-2008, similar pattern of movement was observed in the case of traded stock value which kept increasing consistently over the same period.

Literature review: A plethora of studies have been conducted on the economics of FDI in developing countries over the last three decades. Theoretical research in this area can be roughly categorized into two groups. The first group of studies has provided the theoretical rationale of the effect of FDI inflows on economic growth which is known as the FDI-growth nexus (Romer, 1986;

Table 3: FDI, growth and the environment in Nigeria, 1980-2008

Years	Per capita CO_2	FDI stock (US$ million)	GDP per cap (NGN)	Manu/GDP	Energy consumption per capita	Traded stock value	GDP	Stock traded/GDP
1980-1989	0.837	4425.887	1440.788	8.186	786.746	422.04	187403.5	0.003
1990-1999	0.452	15526.920	1533.667	5.012	779.810	4954.15	280082.7	0.016
2000-2008	0.412	41023.390	1666.230	4.104	770.308	442201.60	510153.2	0.722

WDI (2007)

Lucas, 1988; Rebelo, 1991; Grossman and Helpman, 1991). The second group of studies has attempted to relate theoretical consideration to the impact of FDI on the environment in developing countries which is referred to as the FDI-environment nexus (Pethig, 1976; Copeland and Taylor, 1994, 1995; Porter and van der Linde, 1995). On one hand, researchers from both developed and developing countries have extensively looked into the first issue while, on the other hand, the second category of studies is only sparsely researched in the context of the African continent.

Empirical studies on the FDI-growth nexus: A wide range of studies is available, in the literature, on the impact of FDI on economic growth. Most of these studies have typically adopted standard growth accounting framework for analyzing the effect of FDI inflows on growth of national income along with other factors of production.

De Mello (1997) conducted time series as well as panel data estimation. He included a sample of 15 developed and 17 developing countries for the period 1970-90. The study found strong relationship between FDI, capital accumulation, output and productivity growth. The time series estimations suggest that the effect of FDI on growth or on capital accumulation and Total Factor Productivity (TFP) varies greatly across countries. The panel data estimation indicated a positive impact of FDI on output growth in both developed and developing country sub-samples. However, the effect of FDI on capital accumulation and TFP growth varies across developed (technological leaders) and developing countries (technological followers). FDI has a positive effect on TFP growth in developed countries but a negative effect in developing countries. This pattern is however, reversed in the case of effect on capital accumulation.

De Mello infers from these findings that the extent to which FDI is growth-enhancing depends on the degree of complementarity between FDI and domestic investment in line with the eclectic approach pursued in Dunning. Marwah and Tavakoli (2004) also examined the effect of FDI and imports on economic growth in four ASEAN countries. The elasticity of the estimated production function of FDI was found to be significant in explaining the economic growth of all the four countries. Estimated foreign capital elasticity was found to be 0.086 while import contributed 0.443 to growth in the case of Malaysia. Clearly, they conclude that both FDI and imports had a significant impact on growth.

A recent study by Li and Liu (2005) uses the panel data of 84 countries to investigate the influence of FDI on growth. The study found a significant relationship between FDI and economic growth. Additionally, a stronger relationship was extracted when FDI was interacted with human capital. This is because stronger human capital poses better absorptive capacities due to the complementary nature of FDI and human capital, especially in developing countries. In contrast, there have been several studies indicating a negative or no relationship between FDI and growth.

Empirical studies on FDI environment nexus: Unlike a vast amount of literature that has been conducted on FDI-growth nexus, empirical studies on FDI-Environment nexus are still relatively sparse both in the developed and developing countries. Smarzynska and Wei (2001), Xing and Kolstad (2002), Eskeland and Harrison (2002), He (2006), Baek and Koo (2008) and Acharyya (2009) are among the first set of empirical studies that have attempted to address this issue. For instance, Xing and Kolstad (2002) examine the effect of the US FDI on environmental quality in both developed and developing countries; they find that developing countries tend to utilize lax environmental regulations as a strategy to attract dirty industries from developed countries.

He (2006) explores the relationship between FDI and the environment in China; he unearths evidence that an increase in FDI inflows results in deterioration of environmental quality. However, these studies implicitly assume a one-way causality from measures of environmental quality (SO_2 and CO_2 emissions) and/or economic growth (GDP) to FDI and adopt a structural model (i.e., reduced form equations) to estimate the impacts of FDI based on such causality.

Baek and Koo (2008), using cointegration analysis and a Vector Error Correction (VEC) model, examine the short and long run relationships among Foreign Direct Investment (FDI) economic growth and the environment in China and India. The results show that FDI inflows play

a pivotal role in determining the short and long-run movement of economic growth through capital accumulation and technical spillovers in the two countries. However, a FDI inflow in both countries was found to have a detrimental effect on environmental quality in both the short- and long-run. Also, they found that, in the short-run, there exists a unidirectional causality from FDI inflows to economic growth and the environment in China and India a change in FDI inflows causes a change in environmental quality and economic growth but the obverse does not hold. Acharyya (2009) examines two most important benefits and costs of foreign direct investment in the Indian context GDP growth and the environment degradation. He finds a statistically significant long run positive but marginal, impact of FDI inflows on GDP growth in India during 1980-2003. On the other hand the long run growth impact of FDI inflows on CO_2 emissions is also found to be substantial.

Previous empirical studies on FDI growth nexus in Nigeria: Quite a large number of empirical studies have been conducted on FDI growth in Nigeria. These studies include among others Aluko (1961), Brown (1962), Endozien (1968), Obinna (1983), Oseghale and Amonkhienan (1987), Odozi (1995), Oyinlola (1995), Anyanwu (1998), Ariyo (1998), Adelegan (2000), Ayanwale and Bamire (2001) Jerome and Ogunkola (2004) and Ayanwale (2007). What is clear however, from all these studies is that they all tend to pursue similar objectives which range from: either investigating the determinants of FDI; examining the structure, pattern and trends of FDI as well as assessing the influence of FDI on firm level productivity. Of the studies conducted thus far, it could be said clearly that over 70% were able to establish a positive link between FDI and growth in Nigeria while, <30% establish a negative relationship between the two. It is therefore apparent from the literature search and to the best of the knowledge that none of the studies has been able to examine the FDI, growth and environmental quality nexus for Nigeria. Thus, an attempt at investigating these linkages is the overarching goal of this study.

MATERIALS AND METHODS

The study used annual real GDP per capita and annual per capita CO_2 emission as the proxies for income and pollution respectively and FDI inflow from UNCTAD for the period 1970-2006. The use of CO_2 as a proxy for environmental quality is discussed in Hoffmann *et al.* (2005). The Autoregressive Distributed Lag (ARDL) approach adopted in this study was introduced by Pesaran *et al.* (1996). The ARDL has numerous advantages.

Unlike most widely used method for testing cointegration-the residual-based Engle and Granger (1987) and maximum likelihood-based Johansen and Juselius (1990) tests the ARDL approach can be applied regardless of the stationarity properties of the variables in the sample and allows for inferences on long-run estimates which is not possible under alternative cointegration procedures. In other words, this procedure can be applied irrespective of whether the series are I (0), I (1) or fractionally integrated thus avoiding problems resulting from non-stationary time series data.

Another advantage of this approach is that the model takes sufficient number of lags to capture the data generating process in a general to specific fashion. The model can be selected using model selection criteria like Adjusted R^2, Akaike Information Criteria (AIC) and Schwartz-Bayesian Criteria (SBC), SBC is known as the parsimonious model (selecting the smallest lag-length), whereas AIC and adjusted R^2 are known for selecting the maximum relevant lag-length. Finally, the ARDL approach provides robust results for a smaller sample size in cointegration analysis. Since the sample size is small, 37 observations, there is additional motivation for the study to adopt this approach:

$$\Delta GDP_t = a_0 + \sum_{i=1}^{n} a_{Gi}\Delta GDP_{t-i} + \sum_{i=1}^{n} a_{Fi}\Delta FDI_{t-i} + a_1 GDP_{t-1} + a_2 FDI_{t-1} + \varepsilon_{1t} \quad (1)$$

$$\Delta GDP_t = b_0 + \sum_{i=1}^{n} b_{Gi}\Delta GDP_{t-i} + \sum_{i=1}^{n} b_{Ci}\Delta CO_{2t-i} + b_1 GDP_{t-1} + b_2 CO_{2t-1} + \varepsilon_{2t} \quad (2)$$

The terms with the summation signs in the equations represent the error correction component dynamics while the second part (terms with m_s) corresponds to the longrun relationships.

First of all, the null hypothesis (H_0: $m_1 = m_2 = m_3 = 0$) which indicates the non-existence of the long run-relationship is tested against the existence of a long run-relationship. The calculated F-statistics of the null hypothesis of no cointegration is compared with the critical value tabulated by Pesaran. If the computed F-statistic falls above the upper bound critical value, the null hypothesis of no cointegration is rejected. Likewise, if the test statistics fall below a lower bound, the null hypothesis cannot be rejected. Finally, if it falls inside the critical value band, the result would be inconclusive. Once cointegration is confirmed, the long run relationship

between FDI and other explanatory variables using the selected ARDL models are estimated. The last step of ARDL is to estimate the associated ARDL error correction models.

RESULTS AND DISCUSSION

In Table 4 the OLS results show very poor statistics with none significance of any of the explanatory variables coupled with poor R^2, Durbin Watson and F-statistics. However, with the inclusion of an AR (1) term, improvements were observed in the explanatory variables, in which case, cardon-dioxide per capita is statistically significant while that of foreign direct investment is not significant.

This simply depicts the causal link between environment (as measured by CO_2 capita^{-1}) and growth (proxied by GDP per capita). The coefficient of determination is high given the value of both unadjusted and adjusted R^2. In the ARDL approach, the testing procedure is to estimate the models by ordinary least squares method and thus conduct an F-test for the joint significance of the coefficients of the lagged level of the variables with the aim of testing for the existence of long run relationship among the variables in Eq. 1, 2 that is H_0: $a_1 = a_2 = 0$ against the alternative H_i $a_1 \neq a_2 \neq 0$ for the former while testing H_0: $b_1 = b_2 = 0$ against the alternative $H_1 \neq b_1 \neq b_2 \neq 0$ for the latter.

Co-integration results: The results from Wald tests in Table 5 and 6 show that there was no co-integration between GDP per capita and foreign direct investment in the estimated Eq. 1. This is obvious from the lag running from 1-4 with lower F-statistics as against the Pesaran higher and lower critical bound values.

In Table 6, there appears to be co-integration between the CO_2 per capita and foreign direct investment as the lag 4 F-statistics is higher than both the higher and lower critical bound values. What this suggests is that carbon dioxide emission (a measure of environmental quality) moves pari passu with the inflows of foreign direct investment.

This result is plausible given the existence of Pollution Haven Hypothesis (PHH) which asserts that developed countries would like to relocate their dirty industries because of their stricter environmental controlled countries to the developing countries with lax environmental regulations. With the results the researchers then proceed to estimating an error correction model to equilibrate the speed of adjustment between the short run dynamics and long run equilibrium. The ECM is rightly signed by having negative values. The speed of adjustment hovers around 42%. The intuition behind results lie on the catalytic role FDI has been playing in driving the real growth in the Nigerian economy. The bulk of FDI into the country are traceable to the oil industry in Nigeria, thus the damage emanating from activities such as oil exploration and production. This arguably is one of the major causes of youth restiveness in the Niger-Delta area of the country.

Table 4: OLS results

	Dependent variable: LNGDPCAP	
Variables	Without AR	With AR
C	5.2934* (0.7899)	5.6841* (0.4186)
LNCO^{2}CAP	0.0630 (0.0717)	0.1029** (0.0224)
LNFDI	0.0289 (0.0326)	0.0194 (0.2082)
AR(1)	-	0.9439* (0.0794)
R^2	0.026209	0.832485
Adjusted R^2	-0.03281	0.815734
Durbin-Watson stat	0.193784	1.889923
F-statistic	0.444091	49.69615
Prob(F-statistic)	0.645184	0.0000

*(**) denotes level of significance at 1 and 5%

Table 5: Wald test

	Wald test: Equation 1			
Lag	1	2	3	4
F-statistics	0.0260	0.7012	0.1802	0.5177
Prob	0.9443	0.5078	0.8362	0.6015
Comments	NS	NS	NS	NS

The critical values of the bound test at 97.5% level of significance are 5.77 for lower bound I(0) and 6.68 for higher bound I(1) depict that the F-calculated values are below the bounds. Hence, the null hypothesis of no co-integration is therefore accepted

Table 6: Wald test

	Wald test: Equation 2			
Lag	1	2	3	4
F-statistics	1.478	3.104	2.5012	8.475
Prob	0.2575	0.067	0.1031	0.0013
Comments	NS	NS	NS	NS

The critical values of the bound test at 97.5% level of significance are 5.77 for lower bound I (0) and 6.68 I (1) for higher bound depict that the F-calculated values are below the bounds. Hence, the null hypothesis of no co-integration is therefore rejected

Short-run dynamics of Eq. 2:

$$D(LNCO_2CAP) = -0.020863 - 0.160049D(LNFDI(-1))$$
$$(0.4945) \quad (0.0122)$$

$$-0.202198\,D(LNFDI(-2)) + 0.120509D(LNFDI(-3))$$
$$(0.0026) \qquad (0.1024)$$

$$-0.025301\,D(LNFDI(-4)) - 0.424984ECM(-1)$$
$$(0.6922) \qquad (0.3184)$$

Adjusted $R^2 = 0.482$, F-statistic (Prob) = 5.464 (0.002785), DW = 2.36.

CONCLUSION

The study assesses the 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. The key policy lesson from these findings is that any policy that will aim at attracting foreign direct investment inflows should be one that will encourage and promote the adoption of cleaner production technologies. Also, stricter and total environmental laws and regulation should be instituted so that only environmental friendly goods will be produced.

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