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Abstract

This study focused on the role foreign direct investment plays in the relationship between quality environment and economic growth in Nigeria from 1970 to 2013. The ordinary least squares technique was employed and the key variables include carbon emission, human capital, per capita income, FDI, trade openness, interest rate, inflation rate and the interaction term between environment and FDI. The result showed that all the variables are stationary at first difference and that long run relationship exists among them. It is observed that FDI ratio and environment negatively impact GDP over the period, but the interaction between FDI and environment positively impact economic growth. It is recommended that the country should reform its environmental policies to attract proper and appropriate technology to boost its economic progress as suggested by the interaction term in the model.

KEYWORDS: Environment; Economic Growth; Foreign Direct Investment; Nigeria.

1. Introduction

A pollution haven occurs when dirty industries from developed nations relocate to developing nations in order to avoid strict environmental standards or developed nations imports of dirty industries expand replacing domestic production (Blomquist and Cave, 2008). The 1990s was a decade in which environmental standards were tightened throughout the developed world. This rise in environmental stringency has led to a discussion about the pollution haven hypothesis (PHH). The PHH proposes that environmental stringency differences between developed and developing countries, encourages developing countries to specialize and gain a comparative advantage in the production of "dirty" goods. If the PHH holds, developed nations should observe a rise in imports of "dirty" goods from developing nations, during a period of increased environmental stringency (Blomquist and Cave, 2008).

A critical issue which has emerged as a result of recent trends in globalization is the trade-environment competitiveness issue (Letchumanan and Kodama, 2000). According to classical economic thought, it is believed that free trade will open the flood gates for the migration of highly polluting industries to those countries with weak environmental laws as it is the case with the less developed countries. Therefore, there are already moves to incorporate restrictive trade practices in negotiations at various multilateral trade, investment and environmental initiatives. However, many scholars admit that this will further damage global environmental welfare, apart from polarizing trade and investment patterns. Restrictive trade practices may also hinder the flow of foreign direct investment (FDI) being increasingly relied upon by many developing

countries for the acquisition and upgrading of their technology, thereby adversely affecting national technology development initiatives.

The quest to ensure technology transfer, from developed to developing countries, and also earn foreign exchange necessitates developing countries to open-up trading activities with other countries of the world. Transfer of inappropriate technology through foreign direct investment or trade openness can adversely affect environmental quality. This means that foreign direct investment may have some form of contribution to carbon emission (Copeland and Taylor, 1994; 2004). Studies like Ayadi (2014) and Saibu (2012) affirmed that foreign direct investment inflows fuelled carbon emission per capita in Nigeria. Free trade can induce carbon emission through the consumption of environmental goods, can increase volume of world trade and each country's output, which in-turn deteriorate the environment. Also, through composition effect, developing countries can attract pollution-intensive industries, and developed countries are likely to avoid such industries to attract foreign direct investment (Copeland and Taylor, 2004). As a country becomes wealthy and as income rises, both air pollution and land pollution tend to increase monotonically (Cole et al. 1997; Stern, 2003; Omojolaibi, 2010; Isola and Mesagan, 2014).

The current paper contributes to the above branches of literature by empirically analyzing the relationship between economic growth and the environment as well as determining the effect of foreign direct investment in this relationship. This paper contributes to literature by recognizing the interaction existing between FDI inflows and carbon emission on economic growth which previous studies (Panayotou, 1993; Copeland and Taylor, 1994; He, 2006; Omojolaibi, 2010; Ayadi, 2014; Saibu, 2012; Chung, 2014) failed to capture. The relationship between growth, environment and FDI stems from two perspectives: pollution haven hypothesis and the EKC (Blanco et al., 2013). The analysis is carried out using carbon dioxide emission from manufacturing industries and construction which form a large chunk of FDI inflow into Nigeria.

2. Empirical Review

There are extensive empirical studies on the environment, such as Crocker (1966), Baumol (1971), Eskeland & Harrison (2003) and Taylor (2004). Others like Panayotou (1993), Arrow *et al* (1995), Stern *et al* (1996) and Alstine & Neumayer (2009) focused on the relationship between economic growth and environmental degradation. In a study conducted by Panayotou (1993), it was suggested that a U-shaped relationship exists between environmental degradation and economic growth or per-capita income. This is what has been termed in literature as environmental Kuznets curve (EKC). He (2006), Chung (2014) and Neequaye and Oladi (2015) focused on foreign direct investment and the environment.

Neequaye and Oladi (2015) studied effects of the inflows of foreign direct investment and the disbursements of environmental aid on environmental degradation. The study which employed a panel analysis for some selected developing countries suggested the existence of an environmental Kuznets curve for carbon dioxide as well as total green house gas emissions from both the energy and industrial sectors but also observed that there was no evidence of the EKC for nitrous oxide and total green house gas emissions from the waste sector.

Chung (2014) enquired into how environmental regulation shapes the pattern of foreign direct investment in South Korea through an assessment of the pollution haven hypothesis. Due to the conflicting results observed in the case studies of most advanced economies, due to the deterrent effect of clean technology adoptions on industry migration and the need to minimize the effect of clean technology, the study examined the pattern of South Korean foreign direct investment over 2000 to 2007 which is the period that Korean firms relied on old production technologies despite facing rapidly strengthened environmental standards. The study found strong evidence that polluting industries tend to invest more in countries with relaxed environmental regulations.

He (2006) looked at environmental impact of foreign direct investment in Chinese provinces. It constructed a simultaneous model to study the FDI–emission nexus by exploring both the dynamic recursive FDI entry decision and the linkage from FDI entry to final emission results under the intermediation of the scale, composition and technique effects. The study observed that foreign direct investment inflow has a positive effect on sulphur emission in China.

Tang and Al-mulali (2013) employed fully modified OLS to investigate the validity of pollution haven hypothesis in the Gulf Cooperation Council (GCC) countries and found that foreign direct investment inflows have a long run negative relationship with carbon emission. Some related studies conducted on developed, emerging, and the Central and East European countries like Cole and Elliott (2005) used the panel fixed and random models to estimate the effect of FDI on pollution in Mexico and Brazil. The study observed that foreign direct investment has a significant positive impact on the pollution level in these countries.

3. Empirical Model and Methodology

Following Omran and Bolbol (2003), we specify growth equation as:

$$PCI = \alpha + b_1F + b_2H + b_3Z + \mu \quad (1)$$

Where PCI is Per-capita Income, F is a vector of variables generally recognized to explain growth like human capital (proxy with life expectancy, HC), capital formation (CF) and foreign direct investment (FDI). H is a vector of variables that are under study and presumably could affect growth like environmental degradation (proxy with carbon emission from manufacturing industries and construction). Z is a vector of controlled variables like inflation rate (INF), trade openness (TO), and interest rate (INT).

Using a Cobb-Douglas production, one can specify:

$$Y = A(FS.ED)L^{\alpha}K^{\beta} \quad (2)$$

Where Y is output, A is total factor productivity, FS is stock of FDI, ED is environmental degradation variables, L is labour, K is capital, α and β are share of labour and capital respectively. Taking the log differential of (2) we have

$$Y = A'(FS.dED + ED.dFS)/A + \alpha L + \beta K \quad (3)$$

Where Y represents the growth rate of output and A' is the derivative of A with respect to the interaction between stock of FDI and ED (i.e. FDI.ED). Keeping in mind that dED=FDI and that

$A'Y/A=\lambda$ is the marginal product of total factor productivity due to changes in the interaction term, equation (3) becomes

$$Y=\lambda.FS.dED/Y+\lambda.ED.FDI/Y+\alpha L+\beta K \qquad (4)$$

The term ED.FDI/Y in equation (4) captures the interaction between the environmental degradation variable and the FDI ratio. Also, equation (4) can be transformed from a growth accounting equation to a growth equation in estimable functional form. This can be done if K is proxied by the investment ratio (CF/GDP), $\lambda.FS.dED/Y$ is designated as the constant term, and PCI is plausibly substituted for the growth in Y/L. Taking human capital (HC), ED, and the FDI and capital investment ratios as the elements in the vector R that usually determines growth, equation (4) becomes:

$$PCI=a+b_{11}HC+b_{12}FDI/GDP+b_{13}CF/GDP+b_{14}ED+b_{2}ED.FDI/GDP+b_{3}C+\mu \qquad (5)$$

All variables are as explained above while μ is the stochastic error term. The study employed carbon emission to capture the environment.

Data for the study is extracted from the World Development Indicator (2014) and the Nigerian Bureau of Statistics (2014) and analyzed by the ordinary least squares (OLS) technique.

4. Analysis

Table 1: ADF Unit Root Test Results

Variable	Intercept	Order of Integration
LGDP	-6.689773*(0) [-2.933158]	1
LHC	-8.650404*(0) [-2.933158]	1
LFDIGDP	-3.338078*(6) [-2.945842]	1
LCFGDP	-6.589675*(0) [-2.933158]	1
LED	-9.514998*(0) [-2.933158]	1
LEDFD	-7.770649*(4) [-2.941145]	1
LTO	-8.298008*(0) [-2.933158]	1
INFR	-7.062198*(1) [-2.935001]	1
INTR	-9.252410*(0) [-2.933158]	1

*Note: * significant at 5%; Mackinnon critical values and are shown in parenthesis. The lagged numbers shown in brackets are selected using the minimum Schwarz Information criteria.*

Source: Author's Computation, 2015.

The unit root test result above shows that the real GDP, human capital, FDI, capital formation, environment, the interaction variable, trade openness, inflation rate and interest rate are all stationary at first difference for linear trend test models. This indicates that those incorporated series in the dynamic regression model have no unit-root at first difference with the implication that the series (in their first difference) are mean reverting and convergences towards their long-run equilibrium.

Table 2: ***Restricted Cointegration Rank Test (Trace)***

Hypothesized No. of CE(s)	Eigenvalue	Trace Statistic	0.05 Critical Value	Prob.**
None *	0.714015	175.7721	159.5297	0.0048
At most 1	0.632966	123.1958	125.6154	0.0696
At most 2	0.494248	81.09915	95.75366	0.3290
At most 3	0.388513	52.46737	69.81889	0.5287
At most 4	0.287770	31.80918	47.85613	0.6227
At most 5	0.202152	17.55631	29.79707	0.5989
At most 6	0.131560	8.071125	15.49471	0.4578
At most 7	0.049828	2.146718	3.841466	0.1429

Table 3: ***Restricted Cointergration Rank Test (Maximum Eigenvalue)***

Hypothesized No. of CE(s)	Eigenvalue	Max-Eigen Statistic	0.05 Critical Value	Prob.**
None *	0.714015	52.57626	52.36261	0.0475
At most 1	0.632966	42.09663	46.23142	0.1300
At most 2	0.494248	28.63179	40.07757	0.5171
At most 3	0.388513	20.65819	33.87687	0.7096
At most 4	0.287770	14.25287	27.58434	0.8048
At most 5	0.202152	9.485184	21.13162	0.7915
At most 6	0.131560	5.924408	14.26460	0.6229
At most 7	0.049828	2.146718	3.841466	0.1429

Both trace statistic and Maximum-eigenvalue statistic indicates that there is 1 co-integrating equation at 5% significance level. Hence, a long-run equilibrium relationship exists between the variables and that there exist one co-integrating vector. Since this is the case, we can now proceed to estimate the long run model using the OLS.

Table 4: Long Run Estimates

Dependent Variable: Real GDP					
Independent Variables	**Model 1**	**Model 2**	**Model 3**	**Model 4**	**Model 5**
Constant	6.186	6.370	9.521	9.529	7.112
	(1.76)***	(1.61)	(2.42)**	(2.39)**	(1.62)
LHC	1.588	1.546	0.491	0.490	1.230
	(2.04)**	(1.75)***	(0.53)	(0.52)	(1.11)
FDI/GDP	0.013	-0.000	-0.001	-0.018	-0.060
	(0.45)	(-0.01)	(-0.00)	(-0.13)	(-0.42)
CF/GDP	-2.341	-2.316	-1.774	-1.730	-1.691
	(-4.15)*	(-3.74)*	(-2.86)*	(-2.70)**	(-2.66)**
LED	-0.665	-0.674	-0.761	-0.755	-0.780
	(-3.15)*	(-2.94)*	(-3.49)*	(-3.40)*	(-3.53)*
ED.FD/GDP		0.001	-0.001	0.001	0.005
		(0.10)	(0.938)	(2.47)*	(0.36)
LTO			0.313	0.321	0.327
			(2.47)**	(2.47)**	(2.53)**
INFR				-0.01	-0.001
				(0.36)	(-0.001)
INTR					-0.187
					(-1.24)
R^2 (%)	80	80	83	83	84
Prob(F-statistic)	0.000	0.000	0.000	0.000	0.000
D.W.	1.52	1.52	1.53	1.53	1.54

***Significant at 1% level; **Significant at 5% level; ***Significant at 10% level. Figures between parentheses are the '*t*' statistics.** Table 4 above shows the result of the long run estimates of the relationship between economic growth, environmental quality and foreign direct investment employing real GDP, human capital (measured with life expectancy), gross capital formation (investment-income growth), percentage of foreign direct investment to GDP (FDI/GDP), and the natural logarithm of environmental degradation (LED) proxied with carbon emission from manufacturing and construction activities. The interaction between environment and FDI is ED.FD/GDP, while others like trade openness, inflation rate and interest rate are employed as control variables in the model.

From the first model, the result clearly showed that human capital is positive and significant in explaining changes in economic growth. This is in consonance with endogeneous growth theory which posits that human capital is a key driver of economic growth. The result is similar across the five models implying that for the Nigerian economy to set any growth target, efforts must be geared towards improving human capital through adequate investment in income earning and health enhancing projects. The FDI ratio is found to be insignificant and negative from model 1 to model 5 in explaining changes in economic growth. It is only in the first model that FDI ratio positively impact economic growth, but on the average across the models, it is negative. This is similar to Omran and Bolbol (2003) result, thus proving that FDI ratio on its own does not have an exogeneous effect on growth. Capital formation (CF), which proxy investment in the study,

was found to be significant but negatively impact growth in the study, implying that growth in Nigeria has not been driven by investment efforts as the oil and gas industry contributed a large portion of the country's GDP while the manufacturing sector coupled with low saving rate has hampered growth efforts of the country. Carbon emission (ED) is negative and significant across the five models and on the average, a 1% increase in emission while holding other variables constant will cause economic growth to fall by almost 70%. This is as expected owing to the fact that carbon emission has a significant negative impact on the environment contributing adversely to the people's health and also causing the government to devote huge resources that should have been earmarked for growth and development to taking care of the sick.

Model 2 adds the interaction term between carbon emission and FDI ratio (ED.FDI/GDP) and it is positive on the average, implying that the interaction between environment and FDI ratio will positively impact growth in Nigeria. This is this study's main contribution to knowledge. Models 3 to 5 include the standard control variables: the natural logarithm of trade openness (LTO), which is the sum of the country's total trade as a ratio of the GDP, inflation rate (INFR) and interest rate (INTR). Trade openness is found to be positive and significant in the study and on the average, a 1% increase in trade openness while keeping other explanatory variables constant boost the GDP by 32%. This is also expected as Nigeria is an import dependent country vis-à-vis its export of crude oil in commercial quantities. Inflation and interest rates were found to be negative and insignificant in models 4 and 5. This is not unexpected as economic theory posits that inflation will negatively impact economic growth as it erodes purchasing power. Also, a higher domestic interest rate is expected to scare possible investors in physical capital away with its antecedent negative impact on overall investment, aggregate consumption and consequently, economic growth. Both are also found not to be significant in this study as monetary policy does not play key role in this current research.

5. Conclusion

Emerging literature on foreign direct investment stipulates FDI's positive impact on economic growth depends on the prevailing local conditions in an economy as well as its absorptive capacity (Omran and Bolbol, 2003). This study carried out on the Nigerian economy has been able to confirm this assertion owing to the fact that FDI could not on its own positively impact Nigeria's economic growth sequel to the fact that it negatively and insignificantly impact income earning potential of Nigeria over the period of study. It is only when interacted with the environment (ED) that FDI positively impact Nigeria's economic growth. These empirical results imply that Nigeria should not just concentrate efforts on attracting FDI into its fold as it might not achieve the desired goal of boosting the local economy in any significant positive way.

Moreover, the country should look for ways to control its carbon emission and promote a green growth. This will necessarily enhance the welfare of the citizenry, reduce government's expenditure on health, and act as a spur on economic growth. This is in consonance with the saying that "health is wealth". However, if a safe environment is not guaranteed, the country's lax environmental policies may continue to attract pollution emitting resources from different regions of the world, the expected positive gains associated with FDI inflow will be a mirage and the welfare of the populace as suggested in Copeland and Taylor (1995), Cole et al (1997), Cole and Elliot (2005), Omojolaibi (2010), Saibu (2012) and Isola and Mesagan (2014) will continue

to deteriorate drastically. However, if the country can reform its environmental policies to attract proper and appropriate technology into its fold, there will be significant economic progress as suggested by the interaction term in the model.

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