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Analysis of Pollution Haven Hypothesis in Nigeria

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Abstract
Developing countries like Nigeria cannot do without Foreign Direct Investment (FDI) and robust trading with other countries if they are to succeed in their quest for growth and development. However, caution must be exercised by these countries because FDI and increased trading are not without their own negative consequences. The Pollution Haven Hypothesis (PHH) is often recognized as a negative side of FDI and trade openness. This study is therefore to investigation the Pollution Haven Hypothesis in Nigeria using the Autoregressive Distributed Lag Model (ARDL). The results indicate traces of the pollution haven effect in the country especially through Foreign Direct Investment (FDI) which turned out to be significantly positively related to carbon dioxide (CO_2) emission. Trade openness and per capita GDP also have a positive relationship with Co_2 emission but their coefficients are not statistically significant. The study recommend that corporate headquarters of multinational oil companies should relocate to regions where their exploration and production activities take place as well as the involvement of local experts in the procurement process of equipment of oil multinationals to ensure procuring environmental friendly equipments.

Keywords: *Pollution Haven Hypothesis, Foreign Direct Investment, Trade Openness, CO_2*

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I. INTRODUCTION

There is no doubt that trade liberalization as well as Foreign Direct Investments (FDI) in all ramifications are among major avenues to stimulating economic growth in developing countries like Nigeria. In fact, economic literature is in no short supply of theories and studies justifying the need for not only trade liberalization but also foreign direct investment in developing countries as major sources of growth. For instance, Nguyen and Jonathan (2002) found a domino effect between trade liberalization, Foreign Direct Investment (FDI) and economic growth. They showed that the bilateral trade agreement between the United States and Vietnam increased FDI in Vietnam and contributed to Vietnamese economic growth by 0.6 percent. Similarly, Daniel, Richmond and Eric (2015) established in their study a long term relationship between trade openness, FDI and economic growth in Ghana. They recommended the channeling of FDI to export-oriented sectors and the utilization of export-led growth strategies in the long-term development plans of Ghana.

Based on the foregoing, we can say that trade liberalization and foreign direct investment are important prescriptions (borrowing medical terminology) for stimulating economic growth in developing economies like Nigeria. However, most medical prescriptions do have their side effects which are often negative and medical practitioners do not fail to mention such negative side effects when making such prescriptions to their patients. But it is also common knowledge that many patients ignore the negative consequences of certain prescriptions in their quest to get the benefits of such prescriptions. Thus, we are in good company to ask salient questions such as: knowing very well that the activities of foreign investors and trade liberalization can have negative side effects on their environment; do developing countries such as Nigeria deliberately deemphasize strict compliance to environmental laws in order to attract more foreign direct investments and promote trade liberalization? What is the nature of the relationship between weak environmental regulations in Nigeria and foreign direct investment as well as trade liberalization?

An attempt in economic literature to explain this rather delicate and intricate relationship between weak environmental laws on the one hand and foreign direct investment as well as trade liberalization on the other hand, is the Pollution Havens Hypothesis (PHH). Basically, the Pollution Havens Hypothesis suggests that

because of strong environmental regulations in advanced countries, many companies in advanced countries shift their production activities to developing countries where there are weak environmental laws and regulations. In other words, these companies view developing countries as pollution havens or a willing dumping ground for their activities. This has serious consequences not only on the environment but also on the health of individuals both in the short-run and the long-run.

Aliyu (2005) stressed that the Pollution Haven Hypothesis has three main dimensions. First is the movement of heavy polluting industries from developed countries having strict environmental laws to developing countries without such strict laws or with strict environmental laws that are not being strictly enforced, as a result global free trade would encourage polluting industries to move to countries with weak environmental laws. The second dimension has to do with the dumping of hazardous wastes, both industrial and nuclear, from developed countries into developing countries. This second dimension was the subject of the Basel Convention on the Control of Trans-boundary Movements of Hazardous Wastes and their Disposal which was signed in Switzerland on the 22nd of March, 1989. The final dimension which is obviously very grave is the unrestrained extraction of exhaustible or non-renewable natural resources by multinational corporations engaged in the exploration, exploitation and production of petroleum and petroleum products.

Statement of the problem

The 2019 State of Global Air (SOGA) pollution report identified Nigeria as the second worst country in terms of exposure to particulate matter 2.5 (PM 2.5) in West Africa (Punch, March 26, 2019). Similarly, the World Health Organization (WHO) ranks Nigeria as the fourth most polluted country in the world with at least 150 persons dying per 100,000 persons from pollution related causes (Vanguard, August 31, 2018). Only Afghanistan (406), Pakistan (207) and India (195) exceed the Nigerian figure. These dismal statistics are not surprising if the realities on ground are taken into consideration. For instance, Kalu (2009) pointed out that gas flaring has continued unabated despite government directive to stop gas flaring. Moreover, Nigeria has suffered terribly in terms of oil spillages. It is on record that the Idoho oil spill of 1997 spilled some 40,000 barrels of crude oil into the environment with the spill travelling across Akwa Ibom State to Lagos State. Statistics obtained from the Department of Petroleum Resources (DPR) showed that between 1997 and 2001, there were some 2,097 oil spill incidents in Nigeria amounting to 1,947,600 barrels of crude oil (Ogbonna and Ekweozor, 2000).

Given the foregoing, we are in good company to ask: Is Nigeria a pollution haven? If we assume for a moment that the answer to this question is affirmative, then there are myriads of problems that this creates for the country. While it may be the case that foreign direct investments usually find their way into pollution havens, the negative consequences of being a pollution haven might eventually outweigh the benefits of such foreign direct investments. Thus pollution havens might just be robbing Peter to pay Paul.

There are two broad problems or consequences of being a pollution haven. They are environmental problems and health problems. Clearly, these problems are not independent. Instead, they are closely linked. A country that cares less about compliance to environmental laws and regulations will suffer severe environmental degradation. Air and water pollution will be rife. This will certainly result in both short-run and long-run health challenges for people. This will in turn cause an increase in national healthcare expenditure thereby denying other sectors needed fund. Therefore, the possibility of a country being a pollution haven is not a matter to be treated with levity. Hence there is the need for this study.

The overall objective of this paper is to determine whether the Pollution Haven Hypothesis is applicable in Nigeria. However, in trying to achieve this objective, our discussion will also include issues of Foreign Direct Investment (FDI), trade liberalization or openness and economic growth measured by Gross Domestic Product per capita.

II. .LITERATURE REVIEW

A. Conceptual Clarifications

Pollution: The presence of or introduction of contaminants into the natural environment that can cause adverse change is known as pollution. Pollution may be in the form of chemical substances or energy. Specifically, prominent forms of pollution are water pollution, air pollution, soil contamination, noise pollution, littering, plastic pollution and many more, (Bradford, 2018)

Pollution Haven Hypothesis (PHH): This is basically the supposition that developing countries, either through weak environmental laws or de-emphasis on strict compliance to relevant environmental regulations, attract foreign investors or companies to their climes in order to take advantage of revenue they can generate from these foreign investors. To this end, Folorunso et al (2019) describes the Pollution Haven Hypothesis (PHH) as

the tendency of the relocation of companies from developed countries where there are strong environmental laws to developing countries where environmental laws are not strong.

Foreign Direct Investment (FDI): Any investment in enterprise located in one country but effectively controlled by residents of another country can be referred to as foreign direct investment (UNCTAD, 2009). This includes flows of capital, technology, entrepreneurial skills and even management practices to the host economy where they are used side by side with local factors of production in the production of goods and services (Chenery and Stout, 2006).

Trade Liberalization: Trade liberalization is the removal or reduction of restrictions or barriers on the free exchange of goods between nations. These barriers include tariffs, such as duties and surcharges, and nontariff, such as licensing rules and quotas. (Akomolafe et al, 2015).

Empirical Literature

Although the Pollution Haven Hypothesis (HPP) is a rather fledging area in economics, there is no short supply of studies and robust discussions on the subject matter. However, available empirical works are not unanimous in their take on the relationship between trade liberalization, FDI and environmental regulations as it relates to the pollution haven hypothesis. For instance, studies by List and Co (2000) and Hassaballa (2014) among others show that stringent environmental regulations have impact on the location of multinational organizations across countries or regions. In the same vein, the works of Cole and Elliot (2005) on the US outward FDI show that difference in pollution abatement costs has positive relationships with the FDI outflows across manufacturing firms.

Using disaggregated data and panel data, Aliyu (2005) study the impact of dirty FDI on host economies. His study also made the use of CO2 total emission, the total emission on particulate matters, increasing temperature and total energy use. It was found that environmental policy was positively correlated with FDI outflows in two OECD countries. Besides, FDI was found to be a major variable explaining pollution level and the use of energy in fourteen OECD countries.

Ayadi (2014) adopted the use of Ordinary Least Squares (OLS) in his study of the impact of trade liberalization and foreign direct investment (FDI) on economic growth in Nigeria and the effect of liberalization on the environment based on 1970 to 2012 data. He concluded that trade liberalization and foreign direct investment had a very minimal impact on economic growth but that capital formation was a key determinant of growth in the long run. His study also identified trade liberalization and foreign direct investment as causes of pollution and that trade is beneficial both in the short run and long run.

Focusing on the United States and China, Temurshoev (2006) studied the effect of free trade on the environment by examining which of either theories of Pollution Haven Hypothesis (PHH) and Factor Endowment Hypothesis (FEH) was applicable in the trade between both countries. Essentially, he investigated by how much more will certain pollutants such as NOx, CO2 and SO2 will increase in the United States and China if exports and imports increased by the same amount in both countries. He found that the Pollution Haven Hypothesis (PHH) was unconfirmed by data. In other words, the United States is not a winner in terms of emission in her trade with China neither is China a pollution haven.

In their study, Levinson and Taylor (2003) sought to unmask the sensitivity of investment to environmental regulations in the United States both domestically and internationally. Their conclusion was that differences in pollution across states do not influence decisions on plant location. He posited that more than twenty years of empirical research has not been able to conclusively establish the Pollution Haven Hypothesis (HPP).

On their part, Back and Kim (2011) attempted to establish the dynamic relationships between trade, income growth, energy consumption and CO2 emissions for G-20 countries. They used co-integrated vector auto-regression (CVAR) and Johansen's maximum likelihood to find out that trade and income growth positively affect environmental quality for the developed G-20 countries while they had a negative effect on the environment of the developing countries. but it was found that energy consumption had a negative effect on the environments of both the developed and developing countries.

Danladiand Akomolafe (2006) set out to study the impact of trade openness on pollution and resource depletion in Nigeria. They made use of the Ordinary Least Squares (OLS) and Generalized Least Squares (GLS) methods in their analysis. First, they were able to establish a positive link between trade liberalization and pollution. Second, real GDP per square kilometer as a proxy for economic growth was found to be negatively related to pollution. In the same vein, Feridun and Baloug (2006) studied the relationship between environmental quality and economic growth in Nigeria covering the period of 1970 to 2011. They made use of fractional co-integration analysis and found out that economic development at its early stage tends to provoke

environmental pollution in the country. They also established that uncontrolled trade openness increases the level of environmental degradation.

On their part, Markusen, Morey, and Olewiler (1995) considered government competition in environment and export taxes in situations where there is perfect competition among firms and when there is international mobility of plant locations. They find that given different plant location configurations, equilibria can arise where governments non-cooperatively choose lower environmental taxes to attract multinational production. Thus, in a bid to maximize societal welfare, governments choose lower environmental taxes and trades off consumer surplus, national firm profits, and tariff revenues against the disutility to consumers of higher pollution levels.

Eskeland and Harrison (2003) investigated the pollution haven effect in Côte de Ivoire, Venezuela, Mexico and Morocco by looking at United State outbound investments in these countries. They found out that changes in U.S policy affect the composition of output of U.S FDI in foreign countries. It was also their view that if foreign countries' environmental or trade policies are strategically linked to U.S policies on trade and environment, the results of any investigation of the pollution haven effect in the foreign countries will be largely inconsistent.

Ederington, Arik and Jenny (2005) posited that a pollution haven effect may be difficult to detect in capital intensive industries with large fixed costs, where the movement of production may not be an easy task. In such cases, parameters that are meant to detect pollution or environmental regulation in industries typically thought to be highly polluted may actually mask the pollution haven effects. For instance, it may not be appropriate to proxy the stringency of environmental regulation related to lead, mercury, solid or hazardous waste, biological oxygen demand using parameters of energy intensity or energy measures.

A major problem that have been highlighted by most researchers of the existence of the pollution haven effect in developing countries is the issue of finding an appropriate variable to proxy regulatory stringency. A broad range of proxies can be found to have been used with each researcher arguing in favor of the proxy he or she chooses to use. Some common proxies include emission limits, environmental fees or taxes, permission costs, regulatory delays etc. Each has its distinct merits and drawbacks. However, many writers use some measure of pollution directly as proxy for environmental stringency. This is also problematic because it is observed that while a pollution haven might attract trade and investment, the reverse can also be the case. But the use of a direct measure of pollution as proxy for environmental regulation has become very popular.

Theoretical Literature

In economic literature, trade liberalization and foreign direct investment are said to have their pros and cons. While it cannot be denied that they are ingredients of growth and development, they are often viewed as part of a large number of factors responsible for environmental degradation. This is what the Pollution Haven Hypothesis is all about and it is within this theoretical context that this work is built. More specifically, the Pollution Haven Hypothesis suggests that foreign direct investment is sensitive to weaker environmental regulations.

However, a major question in economic literature relating to the Pollution Haven Hypothesis is how to measure or proxy environmental regulation. Aliyu (2015) explain that different variables have been used as proxies for environmental regulation. They include: consumption energy and dirty fuel, degree of ratification and participation in international environmental protection treaties, index of water and air ambient and emission standards, index of environmental sensitivity performance and environmental and environment related taxes such as pigovian taxes, emission fees/fines etc. It may not be possible to apply uniform proxies for environmental regulation because local conditions differ. Thus, the use of different proxies for environmental regulation may not be a very serious issue bedeviling the Pollution Haven Hypothesis.

Literature Gap

A review of related literature revealed that there is no current known study on Pollution Haven Hypothesis in Nigeria. This study will therefore be a vital addition to the literature on the Pollution Haven Hypothesis in Nigeria.

III. RESEARCH METHODOLOGY

A. Model specification

The functional model for this study is specified as:

$$\mathbf{CO_2 = f(FDI, TR, GDP_p) \quad \ldots\ldots\ldots\ldots \quad (1)}$$

When linearized, the model becomes:

$$\mathbf{CO_2 = a_0 + a_1FDI + a_2TR + a_3GDP_p + u \ldots\ldots\ldots\ldots (2)}$$

Where, CO_2 is total carbon dioxide emission in Nigeria as a proxy for pollution, FDI is foreign direct investment in Nigeria, and TR is trade openness (export plus imports) as percentage of GDP in Nigeria, GDP_p is Gross Domestic Product per capita and u is the stochastic or random term. Note that GDP per capita is included as one of the explanatory variables in this model because it is an indication of the level of economic activities by both nationals and foreigners in a country which is expected to have some impact on the level of pollution in the country. a_0, a_1 and a_3 are parameters to be estimated. Based on the Pollution Haven Hypothesis the a priori expectation is that all the parameters will be greater than zero.
Assuming that the variables in the model are not well-behaved, the model is restated as follows:

$$\mathbf{CO_2 = a_0 + a_1(\Delta FDI_{t-1}) + a_2(\Delta TR_{t-1}) + a_3(\Delta GDPp_{t-1}) + u \ldots\ldots\ldots (3)}$$

Where, Δ is Difference Operator, a_1, a_2 and a_3 are parameters to be estimated, $_{t-1}$ is an Unknown lag and u is Error Term. When cointegration is found between the variables, equation three (3) converges to the Error Correction Model (ECM) as expressed below:

$$\mathbf{CO_2 = a_0 + a_1(\Delta FDI_{t-1}) + a_2(\Delta TR_{t-1}) + a_3(\Delta GDPp_{t-1}) + a_4(ECM_{t-1}) + u (4)}$$

Where, a_4 = Speed of adjustment coefficient

B. Estimation Technique

The Autoregressive Distributed Lag (ARDL) Model and Error Correction Model (ECM) were used in this study to estimate the relationship between the variables in the specified model. The ARDL Model is very useful because it help establish whether the variables have a long run relationship or not, and the Error Correction Model (ECM) was used to determine their short run relationship.

The study used secondary data obtained from the Central Bank of Nigeria Statistical Bulletin, 2019 and the National Bureau of Statistics Report, 2019. The data obtained are: carbon dioxide emission (CO_2), foreign direct investment (FDI) and Gross Domestic Product per capita (GDP).

IV. RESULTS AND INTERPRETATION

A. Unit root test

Table 4.1: Unit Root Test (Augmented Dickey-Fuller Statistics)

Variables	Levels	1st Difference	Order of Integration
CO_2	0.352631	-7.119042	1(1)
FDI	-0.824944	-8.743296	1(1)
TR	-0.385695	-9.368024	1(1)
GDP_P	-0.053849	-5.300870	1(1)

Note: Test done at 5% level of significance. 1(1) indicate stationarity after first differencing
Source: Author's computation

Table 4.1 indicates that all the variables are not stationary at levels and as such the null hypothesis of the presence of a unit root cannot be rejected at levels. However, at first difference, all variables become stationary and on this basis the null hypothesis of non-stationarity was rejected. Having established stationarity of all the variables at first difference, the ARDL Bounds Test is carried out to establish whether the variables have a long run relationship. The results are shown in Table 4.2.

Table 4.2 ARDL Bounds Test Result

ARDL Bounds Test
Included observations: 47
Null Hypothesis: No long-run relationships exist

Test Statistic	Value	K
F-statistic	0.976164	3

Critical Value Bounds

Significance	I0 Bound	I1 Bound
10%	2.72	3.77
5%	3.23	4.35

2.5%	3.69	4.89
1%	4.29	5.61

Source: Authors,computation

The ARDL Bounds Test result in table 4.2 indicates the existence of no long run relationship between the variables. This is because the F-statistic value of 0.976164 is smaller than the upper bounds at the various levels of significance shown. This result forms the basis for the estimation of only the short run relationship using the Ordinary Least Square (OLS) technique. The OLS estimates are shown in table 4.3.

A. Estimation of the Model and Discussion

Table 4.3 Model Estimates

Dependent Variable: D(CO2)
Method: Least Squares
Included observations: 46 after adjustments

Variable	Coefficient	Std. Error	t-Statistic	Prob.
C	1599.364	1577.417	1.013913	0.3164
D(FDI)	6.255707	1.599406	0.392958	0.0363
D(GDPP)	4.297602	5.318409	0.808062	0.4236
D(TR)	2.598273	150.5899	0.017254	0.9863

R-squared	0.821137	Mean dependent var	1360.130
Adjusted R-squared	0.808782	S.D. dependent var	10313.34
S.E. of regression	10561.90	Akaike info criterion	21.45084
Sum squared resid	4.69E+09	Schwarz criterion	21.60985
Log likelihood	489.3692	Hannan-Quinn criter.	21.51040
F-statistic	0.302310	Durbin-Watson stat	2.193621
Prob(F-statistic)	0.823536		

Source: Author

In table 4.3, all the explanatory variables namely Foreign Direct Investment (FDI), trade openness (TR) and Gross Domestic Product (GDP) per capita meet the a priori expectation of having a positive relationship with Carbon dioxide (Co2) emission. This implies that the inflow of FDI into the country, gross domestic product per capita of the country, and Nigeria trade openness contribute to pollution in the country. Moreover, the coefficient of determination and its adjusted form of 82 percent and 80 percent indicates that the model explains at least 80 percent of changes in the dependent variable namely CO_2. The Durbin-Watson statistic value of 2.193612 indicates that there is no autocorrelation amongst the variables in the model. Overall, the above results lend credence to the Pollution Haven Hypothesis in Nigeria and as such the null hypothesis of this work is rejected in favor of the alternate hypothesis is accepted.

V. SUMMARY AND CONCLUSION

At the beginning of this study, we sought to find out whether the Pollution Haven Hypothesis (PHH) is applicable to Nigeria and the broad implications. The results of the analysis have led us to the conclusion that there are traces of the pollution haven effect in Nigeria. Therefore, it is pertinent to ask at this stage: What are the implications or consequences of the pollution haven effect for Nigeria?

The first area of concern is the negative impact on the physical environment in Nigeria. Apart from the twin evil of oil spill and gas flaring which have devastating effect on the environment, there are a host of other externalities of the activities of foreign investors such as soil erosion due to land use for construction work, loss of vegetation and biodiversity, loss of wildlife, water contamination, deforestation and desertification and even the loss of culture. Although the loss of culture may be out of the scope of this work, it is related because the exploration activities of oil multinationals often lead to the physical loss or damage of archaeological or historical sites of cultural significance.

The second consequence of the pollution haven effect in Nigeria has to do with the negative effect on the health of citizens. This consequence became more serious when we take cognizance of the fact that the activities of most foreign investors in the oil sector in Nigeria are in the rural areas particularly in the Niger Delta where people have little or no access to healthcare neither can they afford a reasonably comfortable living. For instance, in communities where gas is being flared the immediate effects are excessive heat and noise, it impacts negatively on the skin of locals and disrupts their sleep since they often cannot afford air cooling

technology for their homes. This is in addition to the fact that gas flaring also results in the inhalation of toxic substances.

Thirdly, the effect on health and environment cannot be overlooked. Since it has been established that the pollution haven effect has physical health implications, it will tend to make expenditure on healthcare very high. The same is true for expenditure on the physical environment. Thus, expenditure for other vital sectors such as education, agriculture and power might be channeled away to counteract the negative consequences of the pollution haven effect.

VI. RECOMMENDATIONS

What then is the way forward? Certainly, doing away with FDI is not an option as FDI remains a major catalyst of growth. Therefore, Nigeria must find a pathway that balances her quest for the benefits of FDI and the possible pollution haven effect it creates. The following can be done.

i. As part of conditions for investing in the country, the Federal Government should ensure that the administrative headquarters of oil firms be located in the areas or regions where their exploration and production activities take place. The simple argument is that if these foreign investors are made to stay in the environment that they pollute, they will care more about the environment. It does not make sense to allow an investor to be polluting region A from his administrative office far away in region Z.

ii. As part of their corporate social responsibility, multinational oil firms should be encouraged to embark on environmental protection endeavors such as curbing erosion, deforestation and desertification. Corporate social responsibility should not be limited to infrastructural and human capital development alone.

iii. Where possible, officials of host governments should be incorporated as part of the team of experts of the multinational companies in charge of the acquisition of key technologies that will be used in host countries. This is to ensure that environmental friendly technologies are acquired.

iv. Ensuring effective and regular maintenance of existing technologies in multinational companies should also be emphasized.

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