The Dilemma of Minerals Dependent Economy: The case of Foreign Direct Investment and Pollution in Nigeria

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ABSTRACT

This study empirically investigates the causal relationship between mineral exploration and environmental pollution in Nigeria with specific focus on natural gas and crude oil in Niger Delta region. The model of Granger causality tests was used. Quarterly data covering 2008 and 2009 were used in accordance with the Akaike (1976) minimum lag length for time-series analysis. The ADF unit root tests show that the null hypothesis of unit root is rejected and, the KPSS stationarity test result accepts the null hypothesis of "stationarity" implying that the variables are fit for the purpose of Granger causality analysis. The test for cointegration show that the variables are cointegrated at the trace level; this imply that gas flaring, environmental pollution and foreign direct investment are statistically linked. The regression on the ordinary least square illustrates that the impact of oil and natural gas exploration on the Nigerian environment is persistent in the long-run. The Granger-causality test result shows that there is one-way causality flowing from the flaring of gas by the foreign firms to the environmental pollution in Nigeria. The study finds a long-run uni-directional causal relationship flowing from mineral exploration to air, soil and water pollution.

KEY WORDS: FDI, Economy, Nigeria, Mineral, Pollution, Africa, Environment

1. INTRODUCTION

The objective of this empirical study was to investigate the causal relationship between the exploration of crude oil and natural gas in Nigeria and environmental pollution.

The lack of willingness by Nigeria to enforce environmental preservation laws against transnational corporations has been at the forefront of debates about the consequences of the inflows of foreign capital into the country.

The extraction of crude oil and natural gas has created severe environmental degradation in the communities where the production activities are being conducted. The environmental impact includes: A large scale contamination of the sources of drinking water; damaging of the inland waterways through the dumping of toxic waste; gas flaring and frequent spillage of crude oil into the environment from ruptured pipelines.

Kingston (2010b) acknowledges that there are very few studies on the impact of mineral exploration in mineral dependent countries in Africa. Alfaro (2003) conducted investigation on the impact of FDI on the host countries using cross-country data from 1981 to1999 and suggests that FDI are only beneficial to the host country in the aspect of manufacturing and not to the extractive sectors.

Ross (2003) suggests that the countries that depend on crude oil exports are likely to experience low economic growth, economic instability and poor governance. The problem with Ross's suggestion is that it is not backed by empirical evidence and hugely focused on governance and economic indicators but fails to take into account of other variables such as standards of living; inflation;

human rights; and, environmental pollution issues.

Xing and Kolstad (2000) suggest that the foreign direct investors whose activities are likely to pollute the environment are not likely to move its capital to countries that enforce tighter environmental laws. Similarly, some studies have found that countries that depend on extractive industries often experience civil crises and civil war (e.g. Fearon and Laitin, 2003; Ross, 2006a and 2006b; De Soysa, 2002; and Collier and Hoeffler, 2004).

Despite the possibility of causing civil conflicts, some studies found that countries that depend solely on mineral resources are likely to have poor standards of living. For example, Al Gedicks (2001) suggest that the foreign direct investors venturing into the crude oil sectors predominantly operates on the indigenous lands in most part of the world and are causing reduction in the people's population by crumbling and demeaning native cultures likely to lower the standards of living and could result in the extinction of the people. However, Al Gedicks did not adduce evidence to back the suggestion that mineral extraction can cause the extinction of a people.

In Nigeria, official government records show that the country's gas reserve is about 183.5 trillion cubic feet (TCF) making the country the highest producer of natural gas in Africa and, among the top ten in the world. The report published by the Oil and Gas Journal in 2009 show that:

> "In 2007, Nigeria produced 1,204 billion cubic feet (Bcf) of natural gas, while consuming 456 Bcf. Approximately 749 Bcf were exported, mostly as liquefied natural gas (LNG). In 2007, Nigerian exports of LNG to the US were 95 Bcf, making it the third largest source of LNG imports after Trinidad (447 Bcf) and Egypt (115 Bcf)."

Despite the huge influence of foreign direct investors in the country's natural gas sector, the equity shares in the industry is held in a joint venture among Nigeria Liquefied Natural Gas (NLNG); the Nigerian National Petroleum Corporation (NNPC); Shell; Total; and, Agip. Despite the shares being held by Nigeria in the joint venture, the foreign experts are co-opted to manage and control the indigenous shares.

The consequence of gas production in the country is gas flaring. Gas flaring has become an integral aspect of gas production in the Niger Delta region where production activities are concentrated. According to the UNDP and World Bank reports (2009):

> "Nigeria flares more than 70 million cubic metres of gas per day, resulting to an estimated 70 million tonnes of carbon dioxide into the Niger Delta environment per day. Consequently; the oil firms in Nigeria account for more greenhouse gas emissions than all other sources in sub-Saharan Africa combined".

In 2001 the UNDP/World Bank Energy Sector Management Assistance Programme express dismay that Nigeria is the "highest gas flaring nation in the world with its gas flaring accounting for about 20% of the global gas flaring". In the same vein, the World Bank report in 2005 show that Nigeria flares about 75% of the natural gas it produces and, the report compiled in 1991 by the "Friends of the Earth" show that Nigeria flares 80% of the natural gas it produces and only closely followed by Libya and Saudi Arabia that flares 20% of their natural gas. Elvidge, *et. al* (2009) compiled a list of top twenty gas flaring countries in the world and ranked Nigeria second after Russia.

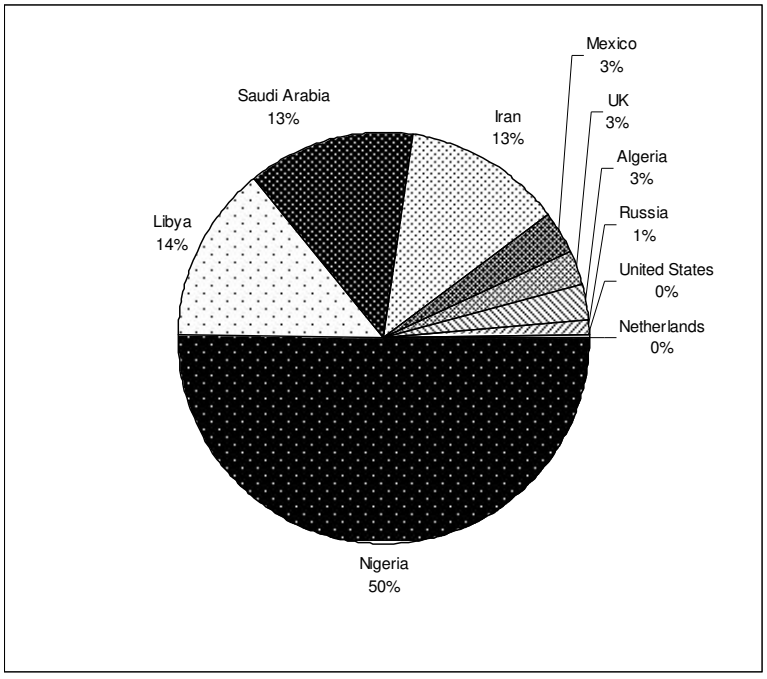
The federal government of Nigeria has show weakness in its ability to minimize and eradicate the menace of gas

flaring in the country. There are numerous anti-pollution laws and regulations in the country but the polluting firms, mostly foreign transnational corporations are not willing to comply with the laws thereby violating human and environmental rights of the inhabitants of the communities where natural gas is extracted. One reason for the lack of compliance by the firms is the lack of deterrence. It is highly probable that gas flaring will never be stopped in Nigeria as predicted in 1963 by the British authorities when they stated that:

> "Shell/BP's need to continue, probably indefinitely, to flare off a very large proportion of the associated gas they produce will no doubt give rise to a certain amount of difficulty with Nigerian politicians, who will probably be among the last people in the world to realise that it is sometimes desirable not to exploit a country's natural resources and who, being unable to avoid seeing the many gas flares around the oil fields, will tend to accuse shell/BP of conspicuous waste of Nigeria's 'wealth'. It will be interesting to see the extent to which the oil companies feel it necessary to meet these criticisms by spending money on uneconomic methods of using gas"(ERA and Friends of the Earth, 2005).

The incidence of gas flaring in Nigeria is rising to an alarming magnitude and the consequences are numerous including: Acid rain; unhealthy temperature of the environment; poor air quality; lung related diseases; and the destruction of the natural habitat of animals and plant species in the Niger Delta area of the country. Reports compiled by the "Friends of the Earth" between 1991 and 2004 show that Nigeria's share of the global gas flaring is 50% and Libya at 14% as illustrated in fig. 1.

Figure 1: The Global Share of Gas Flared in 1991- 2004



Source: Chart Designed based on data from Friends of the Earth, 2005.

An independent toxicology investigation of the Iko Rivers and creeks in the Niger Delta by Ime, *et. al* (2008) finds dangerous degree of concentration "of hydrocarbon degraders and polycyclic aromatic

hydrocarbons in the mangrove ecosystem". The study affirms the prevalence of "variety of hydrocarbons of biogenic, petrogenic and pyrogenic origin which are very resilient organic pollutants which are very dangerous and spreads fast contaminating the environment."

The study finds that the "amount of hydrocarbons such as polycyclic aromatic hydrocarbon in the rivers and neighbouring waterways are those type that are importunate group that easily saturate in aquatic and earthly ecosystems because of their hydrophobic characteristics".

It also suggests that the pollutants are spreading into the waters and soils of the entire Iko area and likely to spread to the "lakes, creeks, estuaries and the adjacent Atlantic Ocean". According to the report compiled by the UNDP on human development in the Niger Delta of Nigeria:

> "Gas flaring amounts to a monumental waste of a valuable resource, on top of the air and thermal pollution that damages biodiversity. Flares cause noise and elevated temperatures. The heat kills vegetation, suppresses the growth and flowering of some plants, and diminishes agricultural production. Plants, animals and humans in the vicinity of the gas flares are perpetually exposed to light with no respite at night. This is harsh for nocturnal animals. The light from flares may also be affecting the endangered marine turtles in the area. Turtles' nesting patterns are influenced by light on their approach to beaches, where they lay their eggs" (UNDP, 2006).

Despite the explicit nature of the UNDP report, it fails to blame the polluting firms and also did not recommend the way forward for the eradication of the menace of gas flaring in Nigeria. As a direct consequence of oil and gas production in the Niger Delta area of Nigeria by the transnational firms, the inhabitants of the affected areas are thoroughly deprived of their rights to safe and healthy environment and facing the worst inconceivable degree of poverty. The government is failing to strike a balance between the economic interest of the foreign business partners and the human rights of its citizens. Thus, the indigenous people are facing health dangers; shortage of food; land shortages; air, land and river pollutions; perennial unemployment; and, forced migration.

It is not all possible to accurately ascertain the exact volume of crude oil that spills into the environment in Nigeria. Some of the oil spillages occur offshore and are under-reported by the firms concern; the oil spillage that regularly occur in the inland waterways are mostly not recorded by the government and the oil firms; even when the records are taken, the full details are often hidden from the public.

However, the records obtained by independent agencies such as the UNDP and "Friends of the Earth" though not very comprehensive, can only be used as yardstick for measuring the incidence of oil spillage in the Niger Delta of Nigeria.

Additionally, some of the evidence of oil spillage compiled for the purpose of this study was based on physical tour of the sites reported by the locals of the affected areas. The total record from all sources which we calculated into single parameter show that an estimated 7,000 barrel of crude oil was spilled into the environment between 1976 and 2009; that is an average of 250 incidence of oil spillage per year during the period. The record also show that nearly 9,1911,426 barrels of crude oil were spilled into environment in the Niger Delta with at least 55% into rivers, creeks and shorelines; and, 45% into farmlands, residential villages, communal access roads and sources of drinking water.

Most of the oil spillages are caused by the rupturing of very old pipelines,

some of which have not been replaced in more than forty years and has been used on daily basis to convey highly pressurised crude oil. In 2009, Shell confirmed that its pipelines in the Niger Delta area are prone to rupturing due to wear and tear occasioned by corrosion and rust. Another reason for regular oil spillage in Nigeria is vandalism from criminal elements that steal crude oil from the pipelines.

The consequences of oil spillages are enormous. It affects humans, animals, plants and aquatic lives. For example, in Ogoni and Odi communities in the Niger Delta of Nigeria, nearly all the sources of drinking water could be seen submerged in black substances flowing from ruptured oil pipelines which have not been attended to by the oil firms for nearly five years. In Iko area of the Niger Delta, several broken pipelines spills huge volume of oil into the surrounding area resulting in the death of crabs, oysters, mudskippers, birds and variety of fishes and mangrove species.

The firms involved in the exploration of crude oil and natural gas are not making conducting remediation of the damages caused by the menace of oil spillage and gas flaring. Shell officials affirmed that "it is a long standing practice of the oil companies to ignore the damages, for natural recovery to occur over few years".

The possibility of natural recovery to occur is very slim in that, the sources of the damages are continuous. In few instances where the oil firms seem to be dealing with the situation, they simply conduct exercises to delude the members of the public. For example, in some of the affected communities, the officials of Shell often tips sand over the pool of oil on the surface of the earth without cleaning up the mess and, when it rains, the sands and the crude oil washes into the lands and waterways.

Kretzmann (1997) examined the impact of oil spillage in Nigeria by obtaining soil samples from Luawii Ogoni and Ukpeleide Ikwerre and finds that the sample from Luawii "contained 18 ppm of hydrocarbons in the water" which is "360 times the level allowed in drinking water in the European Union" and the sample from "Ukpeleide, Ikwerre, contained 34 ppm" that is 680 times more than the 0.05 ppm permitted by the European Union.

Further studies on the environmental impact of oil spillage in the Niger Delta (e.g. Nwilo and Badejo, 2005; and, Ewa-Oboho and Oladimej, 1998) finds that the oil spilling from broken pipes at the Shell facility in the Qua Iboe oil installation in Ibeno clan was conveyed by tidal waves from Akwa Ibom State to as far as Lagos and to Bakassi in Cameroon polluting hundreds of kilometres of the ecosystem (see Nwilo, and Badejo, 2005).

The extent of the environmental damages have not been ascertained however, it is estimated that it must have destroyed huge "number of macro-benthic communities, the dominant species of which included the edible gastropod, *Tympanotomus fuscatus*, the Ocypodid brachyuran, *Uca tangeri* and *Ocypode cursor,* and several species of bivalves and *polychaetes*" (Ewa-Oboho and Oladimej, 1998).

Drilling and dredging has common features of mineral exploration and extraction in Nigeria. Shell and Chevron oil firms admit that it is almost impossible for the oil firms in the country to avoid drilling and dredging activities though, the firms are making efforts to reduce damages to the environment. Noise pollution associated with drilling activities is consistent in the area where oil exploration is taking place in the country.

Despite the loud noises caused by seismic activities associated with drilling; the exercise often involve the dumping of toxic radioactive waste on the surface of the earth and the firms seldom clean up after the exercises.

The wilful negligence of the oil firms causes the loss of vital farmlands and fishing ground of the native people thereby leading to food insecurity and massive unemployment without compensation. Deforestation also occurs

as part of the drilling and dredging processes causing loss of plant species which are important parts of local medicinal requirements.

The use of explosives during seismic activities by the oil firms causes the local dwelling places such as huts and tin sheet buildings to collapse rendering the natives homeless.

The persistence of explosive noises and the frequent flight of the low flying helicopters are nuisance to the inhabitants of the communities where the oil extractions are occurring.

The dredging exercises enable the oil firms to be able to move heavy materials by water to the sites of their exploration activities, some of the disused dredgers and heavy metals are often dumped for years blocking access to farmlands and fishing grounds. Artificial lakes and ponds are often created by the dredging exercises causing stagnant water to accumulate over long period of time thereby increasing breeding grounds for deadly mosquitoes which attacks the natives.

2. METHODS AND MATERIALS

2.1 DATA

The study was conducted in Nigeria within econometric time-series framework using data collected from January 2008 to December 2009 in accordance with Akaike (1976) Information Criterion for time-series analysis.

The data on mineral exploration is the monthly financial records of all crude oil and natural gas produced in Nigeria. The data was obtained from the records of the Central Bank of Nigeria known as the "Monthly Economic Index" of January 2008 to December 2009. The data on environmental pollution is the UNDP and World Bank date of the volume of gas flared by the oil firms in Nigeria between January 2008 and December 2009; and, oil spillage in Nigeria from January 2008- December 2009. The data on mineral exploration represents the independent variable and the data on pollution represents the dependent variable. The Granger causality analysis is conducted in bivariate platform.

2.2 THE EMPIRICAL MODEL

The study employs the Granger causality time series statistical technique in bivariate platform to investigate the relationship between foreign direct investment in the crude oil and natural gas industries and pollution in the Niger Delta of Nigeria.

A time series x_t Granger causes another time series y_t if present value of y_t can be better projected or predicted by using the past values of x_t than by not doing so, taking into account also that other relevant information (including the past values of y_t) are used in either case. Simply put, the Granger (1969) test involves the performance of a regression of variable x_t on its own lag values x_{t-i} and the lag values of second variable y_{t-i} (e.g Kingston, 2010b).

Adequate care is taken to avoid the incidence of serial correlation in the two variables x_t and y_t making it possible for the occurrence of an acceptable level of correlation. If the result show that the coefficient of the lag of any of the variable is significant, it can be said that the variable with the significant coefficient "Granger causes" the other variable.

For the purpose of this study Granger (1969, 1980, 1981 and 1994) method is deployed in conjunction with other time-series test supplements including Johansen (1988); and, Johansen and Jesulius (1990) test for cointegration of the variables. Dickey and Fuller (1979 and 1981) also known as the ADF unit root tests which ascertain whether the variables have a unit root. Where a variable has unit root, it is considered to be non-stationary and can lead to spurious result in time-series regression for this reason an alternative test – Kwiatkowski. et. al (1992) also known as the KPSS test could be used to check for stationarity;

and, the Ordinary Least Square Regression test enable us to find out whether there is a long-run causal relationship between the variables (Kingston, 2010a).

2.2.1 ADF UNIT ROOT TEST

We conducted the ADF unit root test and the KPSS stationarity test on the variables namely – mineral exploration and pollution and found that both variables are stationary. The results are presented in Table 1 below:

Table 1: Results of KPSS Unit Root Tests

Series	Test Statistics			
	ADF		KPSS $_{\mu}$	KPSS $_{\tau}$
	Level (2008)	Level (2009)	Level	
Environmental Pollution	11.23112**(4)	11.22055** (2)	0.110002***(4) *0.113201***(4)*	0.011437***(4) *0.021460**** (4)
Mineral Exploration	12.60238** (4)	10.34010** (2)	0.112350*** (4) *0.115519***(4)	0.111072***(4) *0.1210439***(4)
First Difference				
Environmental Pollution	7.00123** (4)	10.81439** (2)	0.115467(4) *0.113418(4)*	0.1512251(4) *0.1494567(4)*
Mineral Exploration	7.12994**(4)	10.93474**(2)	0.137912(4) *0.115987(4)*	0.177635(4) *0.170283(4)*

Note: The abbreviation μ and τ represent the models with drift and the trend. The results in *italics* represent results for 2009 data series on the KPSS; ** represents the rejection of the existence of unit root at 1% and 5% of the ADF critical values. The figures in parentheses are the lag of the determination of both models. The ADF lag is selected in compliance with Akaike Information Criteria (AIC) (see Akaike, 1976). The ADF critical value is 1% and 5% respectively. The KPSS critical value is 0.216, 0.176, 0.146 and 0.119, in conformity with the upper tail critical values as stipulated by Kwiatkowski et. al. (1992). The asterisks *** signifies acceptance of the null hypothesis of stationarity.

2.2.2 COINTEGRATION TEST

The tests were conducted by deploying the methods of Johansen (1988); and, Johansen and Juselius (1990) involving two steps namely "trace test" and "maximum Eigenvalue test" as follows:

(a) The trace test (λ_{trace}) is represented as follows:

$$\text{Trace} = -T\sum_{i=r+1}^{n} \log(\hat{\lambda}_i) \qquad (1)$$

In equation (1); the null hypothesis is that the cointegration vectors is $\leq r$ as oposed to the reverse hypothesis that the cointegration vectors = r.

(b) The maximum Eigenvalue test (λ_{max}) is represented as follows:

$$\lambda_{max} = -T\log(1-\hat{\lambda}_i) \qquad (2)$$

In equation (2) the null hypothesis is that the cointegration vectors = r as opposed to the optional null hypothesis that the cointegration vectors = r+1. The results are presented in Table 2 below:

Table 2: Johansen Cointegration Test

Results for x_t and y_t Series				
Null hypothesis	Maximum Eigenvalue	1% Critical value	Trace Statistic	5% Critical value
Mineral Exploration (x_t)				
R = 0	3.0210**	4.1041	5.613**	8.704
R < 1	8.6571	9.0021	27.432	10.987
Pollution (y_t)				
R = 0	3.000**	4.561	7.0449**	12.432
R < 1	5.190	7.361	9.119	10.406
** Implies rejection of the null hypothesis of NO COINTEGRATION at 1% critical level				

Table 2 presents the result of the Johansen cointegration tests. It show that the hypothesis of "no cointegration" (r = 0) at 1% and 5% level is rejected. The result also show that the hypothesis of "no cointegration" (r < 1) is also rejected at 1% and 5% critical level implying that the variables are co-integrated. It also shows that there is long-run equilibrium relationship between the exploration of crude oil and natural gas and air, water, soil pollution in Nigeria.

2.2.3 GRANGER CAUSALITY TEST

We conducted the Granger causality tests using the models in equations (3) and (4) aided by the deployment of *Microfit 5.0* software which considers the bivariate linear auto-regressive model of variables x_t and y_t.

$$\chi_t = \alpha_0 + \sum_{i=1}^{p} \alpha_i \chi_{t-1} + \sum_{i=1}^{p} \beta_j y_{t-j} + \varepsilon_{x.t} \qquad (3)$$

$$y_t = \alpha_0 + \sum_{i=1}^{p} \alpha y_{t-1} + \sum_{i=1}^{p} \beta_j \chi_{t-j} + \varepsilon_{y.t} \qquad (4)$$

Table 3: Results of the Granger Causality tests

Null Hypotheses	Observations	F-Statistic	P-Value
The exploration of crude oil and natural gas in Nigeria "Granger" causes environmental pollution.	24	77.039	-0.0001***
Environmental pollution "Granger" causes the exploration of crude oil and natural gas in Nigeria.	24	56.720	9.902**
** Implies rejection of the null hypotheses at 1% and 5% critical levels *** Implies acceptance of the null hypotheses at 1% and 5% critical levels			

Some lessons could be learned from the result of this test. Firstly, it proves that increases in air, water and soil pollution in the Niger Delta of Nigeria over at least two

year period tends to follow the increase in the exploration of crude oil. Secondly, the increase in pollution is not found to have a feedback effect on mineral exploration. There is therefore, a one-way Granger causality from mineral exploration to pollution.

2.2.4 ORDINARY LEAST SQUARE REGRESSION (OLS)

We deployed the OLS regression to check the long-run relationship of the variables. The test was conducted using the Microsoft Excel for windows 2007 version. The results are presented in Table 4.

Table 4: ORDINARY LEAST SQUARE (OLS) RESULTS
(January-December 2008 and January –December 2009)

SUMMARY OUTPUT

Regression Statistics	
Multiple R	0.856432
R Square	0.733476
Adjusted R Square	0.706824
Standard Error	18.72126
Observations	24

ANOVA

	df	*SS*	*MS*	*F*	*Significance F*
Regression	2	9645.398178	9645.398	27.52011	0.000375563
Residual	20	3504.853914	350.4854		
Total	22	13150.25209			

	Coefficients	*Standard Error*	*t Stat*	*P-value*	*Lower 95%*
Intercept	4.754848	17.64130046	0.269529	0.793002	-34.5524185
X Variable 1	1.014152	0.193320469	5.245962	0.00037**	0.58340694

** Indicates significance at 1% critical value

The results of the OLS in Table 4 show that the coefficient of determination is 0.733476 meaning that approximately 73% of y_t can be explained by x_t. In essence, 73% of environmental pollution in the Niger Delta of Nigeria can be explained by the exploration of crude oil and natural gas. The p-value is 0.00037, therefore $p < 1$ and significant at the 1% critical level suggesting that there is long-run equilibrium relationship between the variables.

3. RESULTS AND DISCUSSION

This study was aimed at examining the causal links between the exploration of crude oil and natural gas and environmental pollution (i.e. air, water and soil pollution) in Nigeria using Granger causality time series econometric analysis.

The unit root tests reveal that the variables were stationary and suitable for the study. The cointegration test results reject the null hypothesis of "no cointegration" implying that the variables were integrated in the same order I(1) thus fulfils the empirical requirement of the study.

The Granger causality test results show that there in one-way causality relationship flowing from the extraction of crude oil and natural gas to environmental pollution in Nigeria thus, it could be

construed that the mineral exploration causes pollution in Nigeria.

The reverse hypothesis of environmental pollution causing the exploration of crude oil and natural gas was rejected.

The Ordinary Least Square regression statistic confirms the existence of a long-run equilibrium relationship between the variables, meaning that environmental pollution in Nigeria will continue to be associated with mineral exploration.

The OLS test result further show that at least 73% of the environmental pollution in Nigeria can be attributed to the exploration of crude oil and natural gas and the probability of the eradication of pollution whilst the exploration of crude oil subsists is less than 1%.

The results of the study illustrate that the prevalence of pollution in Nigeria's oil communities is beneficial to the firms that are engaged in the exploration exercises because it reduces the transaction cost as they do not have to compensate for the damage caused to the environment due to the laxity of environmental protection laws which effectively has turned Nigeria into "pollution heaven" (e.g Scott, 2004).

The study further finds that gas flaring causes the temperature of the Niger Delta region of the country to rise to unhealthy and very dangerous levels creating imbalance in the environment and causing acid rainfall that destroys plants and animal species. It finds that the spilling of crude oil into the environment contaminates soil and water sources without remediation by the polluting firms.

It finds that the dependency on minerals for the sustenance of the Nigeria's economy is bad for the environment and the possibility of achieving sustainable development by minerals dependent economy is highly unlikely.

The study finds that Nigeria is Africa's "pollution heaven" (see Potter, 1990) and that the problem hinges upon the federal structure of the country which is very deficient and relatively dysfunctional.

The federal institution of Nigeria is indicative of unitary system in that vital powers are concentrated in the centre in such ways that the sub-federal states are powerless to enforce environmental laws without going through extensive and difficult bureaucratic channels of the central government.

The federal institution depend on the income from crude oil and natural gas for sustenance without which the federal structure is likely to collapse therefore, the government is unwilling to impose deterring conditions on the oil firms as not to disrupt and diminish the activities of the firms.

Nigeria therefore is very actively racing to the bottom and will likely "stuck at the bottom" (e.g Gray, 2002) as it gets into "regulatory chill" to protect its economic survival and to preserve the economic interest of the transnational oil firms.

The study finds that Nigeria's pollution problem is uniquely different from pollution occurring elsewhere in the world for two reasons. Firstly, the federal institution is so deficient to such an extent that it relies on foreign assistance for military and economic supports and therefore shall always lower its law enforcement powers to sustaining the foreign investors, this effectively means that Nigeria is engaging in the "race to the bottom" (e.g Meisel, 2004); Secondly, the federal government is structured in a semi-unitary format whereby the centre does not share fiscal control and law enforcement powers with the periphery.

The centralised form of control facilitates corruption enabling the foreign oil firms to manipulate the corrupt government officials at the national level to enable the foreign firms to conduct oil exploration recklessly without the need to worry about possible sanctions from the government.

The study also find that, as direct consequences of the perpetual gas flaring and oil spillage, the local people in the

immediate areas where the exploration activities are being carried out are deprived of good standards and quality of living and the ecosystem is under constant threats whilst the traditional sources of income such as fishing and subsistence farming are diminishing. The sources of drinking water are often submerged and polluted by crude oil and there is lack of willingness by the oil firms to clean-up and conduct remediation.

4. CONCLUSION

The policy implications of the study are wide ranging. The host developing countries where foreign corporations are engaged in the extraction and exploration of mineral resources should understand that the lowering of environmental protection standards in anticipation of gaining competitive advantages destroy the environment and violate the rights of the humans and causes degradation of the ecosystem. Where there is a long-run effect of environmental pollution as the study of Nigeria has shown, there is a very slim chance of sustainable development and economic progress occurring.

The only viable option for any government to take is to nationalise the mineral resources and related industries and to adequately enforce the environmental laws irrespective of whether it affects the transnational firms or the local industries.

REFERENCES

Akaike, H. (1976) Canonical correlation analysis of time series and the use of an information criterion, cited in *Systems* Identification, ed. R. K. Mehra & D. G. Lainiotie, 27-96. New York: Academic Press

Al Gedicks (2001) Resources Rebels, Canada: South End Press

Alfaro, L (2003) Foreign Direct Investment and Growth: Does the Sector Matter? Harvard Business School, April 2003

Collier, Paul, and Anke Hoeffler (2004) "Greed and Grievance in Civil War" Oxford Economic Papers 56, 663-95

De Soysa, I (2002) 'Paradise is a Bazaar? Greed, Creed, Grievance and Governance', *Journal of Peace Research* 39(4): 395–416.

Dickey, D. A. and Fuller, W. A. (1981) "Likelihood Ratio Statistics for Autoregressive Time Series with a Unit Root", Econometrica, 49, 1057-72.

Elvidge, CD; Ziskin, D; Baugh, KE; Tuttle, BT; Ghosh, T; Pack, DW; Erwin, EH; Zhizhin, M (2009), A Fifteen Year Record of Global Natural Gas Flaring Derived from Satellite Data. *Energies 2* (3) 595-622. http://www.mdpi.com/1996-1073/2/3/595/ [Accessed 30/12/2009]

Engle, R F. (1982) Autoregressive Conditional Heteroscedasticity with Estimates of the Variance of United Kingdom Inflation, Econometrica, 50(4), 987-1007

Engle, R F., and Manganelli, Simone (1999) CAViaR: Conditional Autoregressive Value at Risk by Regression Quartiles, University of California, San Diego, Department of Economics Working Paper 99-20.

Engle, Robert F., and Mezrich, Joseph (1996) GARCH for Groups, RISK, 9(8), 36-40.

Engle, R F., and Ng, Victor, (1993) Measuring and Testing the Impact of News on Volatility, Journal of Finance, 48, 1749-1778

Ewa-Oboho, I. and Oladimej, O. (998) Studies on the Short-Term Effects of the Mobil Idoho Oil Spill on the Littoral Biota of South-Eastern Nigeria, being a joint study for Institute of Oceanography, University of Calabar, P.M.B. 1115, Calabar, Nigeria and the department of Food Technology, Awolowo University, Ile-Ife, Nigeria

Fearon, J D & Laitin, D. D (2003) Ethnicity, insurgency, and civil war; American Political Science Review 97(1): 1–16.

Friends of the Earth (2005) "Gas Flaring in Nigeria: A Human Rights, Environmental and Economic Monstrosity", Published by "Environmental Rights Action and Friends of the Earth".

Gray, K. R (2002) "Foreign Direct Investment and Environmental Impacts: Is the Debate Over?" London: Blackwell pp. 306-312.

Granger, C. W. (1969) "Investigating Causal Relations by Econometric Models and Cross-Spectral Methods", Econometrica, 37 (3), 422-438.

Granger, C. W. (1994) "Some Comments on Empirical Investigations Involving Cointegration", Econometric Review, 13 (3), 345-350

Granger, C. W. (1980) "Testing for Causality", *Journal of Economic Dynamics and Control*, 2, 329-352.

Granger, C. W, J. (1981) "Some Properties of Time Series Data and Their use in Econometric Model Specification", Journal of Econometrics, 16, 121-130

Ime R. Udotong, Samuel I. Eduok, Joseph P. Essien, and Basil N. Ita (2008) "Density of Hydrocarbonoclastic Bacteria and Polycyclic Aromatic Hydrocarbon Accumulation in Iko River Mangrove Ecosystem, Nigeria"; Report sponsored and published by the World Academy of Science, Engineering and Technology Volume 34, found online at: http://www.waset.org/journals/waset/v44/v44-136.pdf [Accessed 7/10/2009]

Johansen S. (1988) "Statistical analysis of Cointegration vectors", Journal of Economic Dynamics and Control, 12:231-54

Johansen, S. and Jesulius, K. (1990) "Maximum likelihood estimation and inference on cointegration-with application to the demand for money", Oxford Bulletin of Economics and Statistics, 52: 169-210

Kingston, K G (2010a) The Dynamics of Gang Criminality in Nigeria: A Time Series Analysis, The Journal of Social Criminology ~ Vol. 3.1, Autumn/Winter, Republic of Ireland: Greenhouse Press

Kingston, K G (2010b) (Unpublished) Environmental and Human Rights Implication of Foreign Direct Investment in Nigeria: The Case of Minerals Exploration in the Niger Delta, PhD Thesis, School of Law, University of East London

Kretzmann, S and Wright, S (1997) Human Rights and Environmental Information on the Royal Dutch/Shell Group of Companies, 1996-1997: An Independent Annual Report(San Francisco and Berkeley, CA: Rainforest Action Network and Project Underground, May 1997), p.6.

Kwiatkowski, D., Phillips P.C.B., Schmidt P., Shin Y. (1992) Testing the null hypothesis of stationarity against the alternative of a unit root; Journal of Econometrics 54, 159-178

Meisel, N (2004) Governance Culture and Development: A Different Perspective on Corporate Governance. Organisation for Economic Co-operation and Development; Illustrated edition, p. 41

Mohan, R. (2006); "Causal Relationship Between Savings And Economic Growth In Countries With Different Income Levels." Economics Bulletin, Vol. 5, No. 3 pp. 1−12)

Nwilo, P.C. & O.T. Badejo, (2005): Oil Spill Problems and Management in the Niger Delta. International Oil Spill Conference, Miami, Florida, USA

Porter, M. E. (1990) The Competitive Advantage of Nations. New York: Free Press.

Porter, C (1999) "Trade Competition and Pollution Standards: Race to the Bottom or Stuck at the Bottom" 8:2 Journal of environment and Development, 133

Ross, M. L. (2003) *Nigeria's Oil Sector and the Poor*, Prepared for the UK Department for International Development "Nigeria: Drivers of Change" program (May 23)

Ross, M (2006a) Mineral Wealth and Equitable Development, A Background Paper for the World Development Report

Ross, M (2006b) "A Closer Look at Oil, Diamonds, and Civil War" Annual Review of Political Science 9: 265-300

Scott, W.R (2004) Institutional Theory: Contributing to a Theoretical Research Program, in *Great Minds in Management: The Process of Theory Development,* Ken G. Smith and Michael A. Hitt, eds. Oxford UK: Oxford University Press.

UNDP (2006), UNDP: Niger Delta, Human Development Report (Nigeria)

UNDP and World Bank (2009) "Strategic Gas Plan for Nigeria, Joint UNDP/World Bank Energy Sector Management Assistance Programme (ESMAP)" found online at: www.bayelsa.org.uk/bayelsa-state-environment.html [accessed 30/6/2009]

United States Energy and Information Administration and, the Oil and Gas Journal (OGJ), 2009

Xing Y and Kolstad C D. (2000) Do Lax Environmental Regulations Attract Foreign Investment? Paper of the International Development Program, International University of Japan and Department of Economics, University of California, Santa Barbara, CA 93106-9210 USA