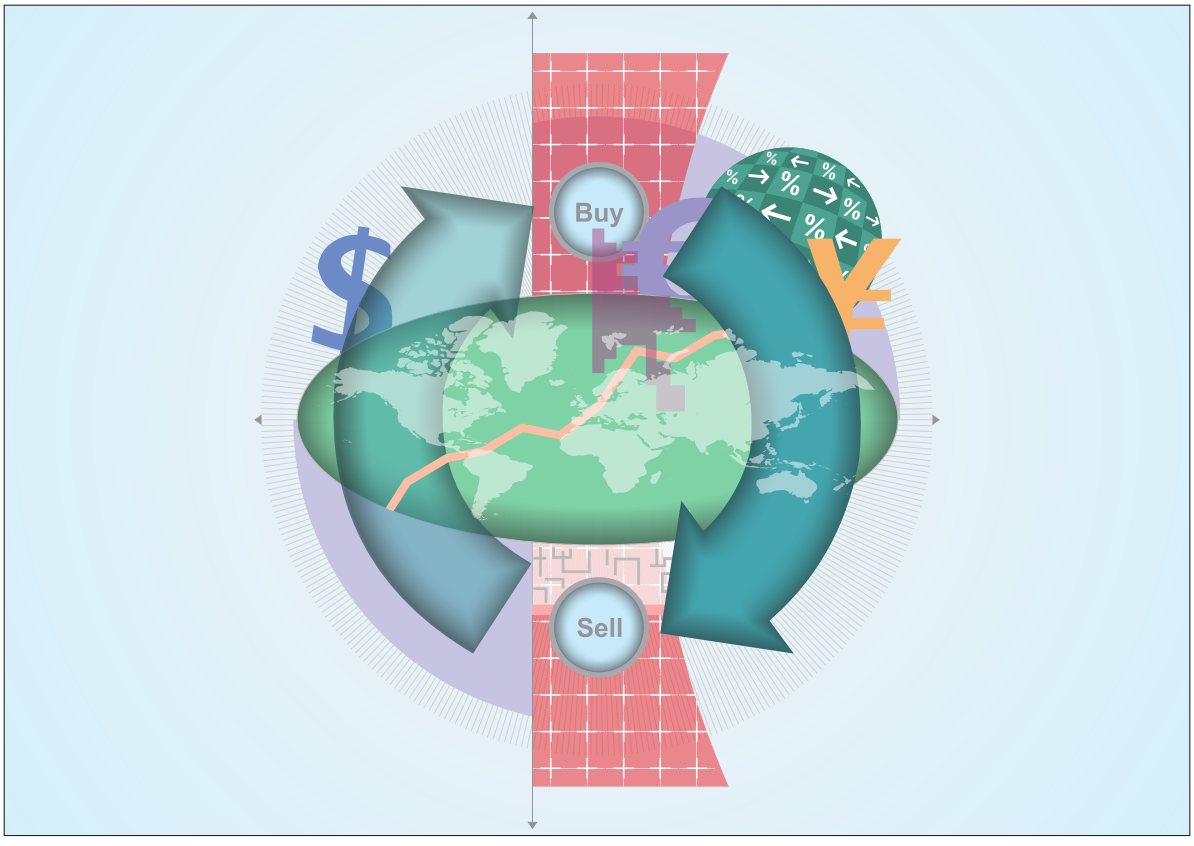

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Foreign Direct Investment and Environmental Degradation of Oil Exploitation: The Experience of Niger Delta

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ABSTRACT

This study examines the impact of foreign direct investment in oil sector and environmental Degradation of oil exploitation. It also examines the socio-economic for sustainable development in Niger Delta. Applying Logit regression analysis on the surveyed data obtained from two oil rich communities in the Niger Delta. The results of the study shows that a unit increase in the volume of FDI into the oil sector significantly raises oil spillage, land degradation and air pollution. Consequently, while health hazard of the people is rising and their health is worsen, agricultural output fell. Compensations paid by oil firms to rural farmers and fishermen when their personal rights are violated have not significantly impacted on agricultural outputs, although it does enhance their income level and education access. The paper establishes that natural resource endowment determines the level of economic activities and income generation capacity but not the standard of living. There are needs to set environmental policy and to monitor progress towards meeting society environmental goals; a reliable information system and database for degradation of environment are needed.

Key words: FDI into oil sector, environmental concerns, logit regression, Niger delta

INTRODUCTION

The developing countries and transition economies are still making more concerted effort towards pulling quality Foreign Direct Investment (FDI) from the developed nations, what they predominantly consider as priority FDI that can bring tangible benefits, especially by contributing to new technologies and better organization practices (Van Beers, 2003). Incorporating the expertise accompanied by FDI can form development strategies of a receiving country.

Foreign investment is an important part of foreign capital because it provides means for increasing the use of existing capacity and to stimulate new investment especially in underdeveloped countries. Following a critical performance of the Nigeria state, particularly after the inflow of FDI since 1970s, several scholars have described their involvement as exploitative and irresponsible. Okowa (2005) noted that countries that are resources poor developed rapidly than resource rich countries. The larger the dependency on oil and mineral resources, the worse the

performance has been. Okaba (2005), submit that within the geo- political space of Sub-Saharan African are ten major oil exporting countries ; Angola, Chad, Cameroon, Congo- Brazzaville, DR. Congo, Gabon Equatorial Guinea, Nigeria, Sudan and Sao- Tome. Average oil production in the region for 2008 has been 6.8 million bdp, with increases concentrated in four countries (Nigeria, Angola Algeria and Equatorial Guinea). In 2005, the Gulf of Guinea region received the world biggest quantity of offshore hydrocarbon capital investment with Nigeria and Angola. It is obvious that African oil exporting nations have over the years raised so much revenue through royalties; levies from oil taxation, joint venture agreement, signatory bonuses and share of production. Oil revenue play leading roles in these nation's average GDP (UNCTAD, 2006).

There is often a disparaging environmental transformation emanating from the business and industrialization particularly in crude-oil. Oil spill and gas flares have destroyed the natural resources base, crucial to sustaining independent indigenous livelihood. In most parts of rivers and Delta states for instance, the hitherto very fertile lands are no longer productive. The peasants have lost the fertility of their lands to oil exploration. The resultant alienations of the people from their homeland and local substance base have intensified ineffective and inequitable l and use practices. In fact, various attempts by the local people to avenge this economic disarticulation perpetrated by the state and oil companies have led to frequent loss of valuable lives and property. There are some negative aftermath occasioned by socio-economic impacts and harsh ecological dilapidation and the disruption of the community living of the Niger delta society.

Consequently the region's natural resources are diminishing and they are not being replaced by human and physical capital. With a growing population, the per capita resource based in the region has gone down. The sustainable economic growth in terms of increases in the per capita availability of resources does not exist.

The Nigerian state has demonstrated over the years that the people and the environment of the Niger Delta region is relevant to the nation only as a viable economic reservoir. The nation pays lip services to the frequent ecological disasters threatening the people on seasonal bases. Social infrastructures in this region are near absent. To worsen the matter, the multi-nationals oil companies take advantage of the naivety, lack of political will and corruption of the Nigerian state to breach with impunity most Memoranda of Understanding (MOU) signed with oil bearing communities. They also violate municipal and international environmental protection laws. The crises between oil companies and host communities between 2003 and 2005 are traceable to the disrespect for MOU by oil company officials (Okowa, 2005; Okaba, 2005).

This study investigates the environmental implications of FDI into the oil sector in the Niger Delta. By extension, implications of such investment for education, health and the economy of the area are examined. The major hypothesis tested is that FDI into the Nigeria's oil sector have negative impact on the socio-economic development and environmental degradation in Niger Delta.

LITERATURE REVIEW

FDI is pertinent for improving a country's economy since it enhances the existing capital towards promoting economic growth that can raise standards of living of the people. It can also promote sustainable economic development through acquiring new technologies and skills as well as methods of production. In addition, it can facilitate global markets, improve effectiveness of resource use, waste and pollution reduction, raise services and create production range (UNCTAD, 1997; Heller, 2004).

Past empirical findings have shown a long run significant marginal positive impact of FDI inflow on GDP growth (Borenstein *et al.*, 1998; Glass and Saggi, 1998; Vu, 2008). The long run growth impact of FDI inflow on emissions has also been quite large. The actual impact on the environment, however, may be larger because emission is one of the main pollutants generated by economic activities.

Increased openness to foreign investment to accelerate resource use patterns is unsustainable because of the deficiency of laws governing natural resource exploitation and its poor enforcement in most developing countries. The capacity of developing countries to attract FDI, maximize the related benefits and minimize the risks depends on the usefulness of their institutional and policy frameworks (Tatic, 2008).

Reducing the pollution emission might cause the reduction in allocation of output of pollution-intensive goods. If there is no change in the strength of emission in an industry with a constant scale of the economy, the effect would reduce the total pollution. The scale of effect at low income and output seems to be prominent and leads to degradation of the environment due to inflow of FDI. Nigeria has experienced speedy economic growth after adopting liberal economic policies during the past few decades. Lately, interest has been turned to the potential impact of variation in environmental regulations. Regulation of industrial pollution increases with economic advancement (Acharyya, 2009).

The origin and sources of environmental degradation in Nigeria spring from many of the very factors that some social scientists like Rao (1952), Bruton (1955) and Lele (1991) have described severally as "the engine for economic growth". These sources include, among others, deforestation for fuel wood, strip-mining for coal or mineral, explosive birth rate, dredging for crude oil and wide spread industrialization. These have led to reduction of the value of the ecosystem.

Oil production activities like flaring of gas and oil spillage have since degraded the ecosystem, as seen in the Niger Delta. A survey done in Rivers State in Nigeria indicated that oil spills on land were the most common complaint (Baumüller *et al.*, 2011). The survey also found that individuals in the communities felt the impacts of oil company activities mostly in the environment, followed closely by health. While arguably more severe than gas flaring in its immediate negative impacts in the Niger Delta context, oil spills are much more difficult to resolve, as the issue is fraught with the politics of scams, sabotage, theft and genuine grievance (Baumüller *et al.*, 2011). The health of the people is impair once polluted food is consumed. People contacted diseases that sometime lead to death by drinking polluted water. Adequate compensations are not given to those suffering from oil production activities (Bojang, 2009).

METHODOLOGY OF THE STUDY

On the basis of pervasive oil production activities in Burutu and Ogulagha, Niger delta in Nigeria, these two communities were selected as the study areas and they have 4500 households. The Krejcie and Morgan (1970) approach was adopted for selecting 354 households as a representative sample. The questionnaires used for collecting data targeted the house heads only. However, only 338 copies of the questionnaires were found to have complete responses among the copies that were returned. In other words, approximately 95% of the questionnaires were successfully completed. This was considered adequate for the analysis.

The explained variables used are categorized into, social issues, economic issues and environmental issues. The social issues include employment of indigenes (Emp); education facilities in the host communities (Edu) and health hazard of the host communities (Health); economic issues

are income level of the indigenes (income) and agricultural output of the indigenes (Agr). While the environmental issues considered are oil spillage (Oilspil), land degradation (Landdegr) and air pollution (Airpoll). The explanatory variables are: provision of public amenities by the oil companies to the communities (PPA); cost of health resulting from activities of the oil companies in the communities (CHE); foreign direct investment into crude oil in the communities (FDIoc); employment provision by the oil companies to the indigenes of the host communities (EP); compensation payment made to the indigenes in case there is violation of their property rights by the activities of oil companies in their communities (COMP).

The logistic regression model is used to evaluate the hypothesis that FDI into oil exploitation in Nigeria has adversely impacted on the environment and the people of Niger Delta. The basic model follows the structure developed by Davidson and MacKinnon (1992). Powers and Yu Xie (2000) among several other researchers have provided justification for this approach.

This study adopted Logit model because of its comparative simplicity. The structure of the models follows:

$$P_i = \beta_1 + \beta_2 X_1 \tag{1}$$

Explicitly, Eq. 1 is re-written as:

$$p_i = \frac{1}{1+e^{-(\beta_1+\beta_2 X_i)}} \tag{2}$$

More clearly, Eq. 2 can be re-written as:

$$P_i = \frac{1}{1+e^{-z_i}} = \frac{e^{z_i}}{1+e^{z_i}} \tag{3}$$

where, $Z_i = \beta_1 + \beta_2 X_i$

Equation 3 represents what is known as the logistic distribution function. It will be easy to verify that Z_i ranges from -8 to +8, P_i ranges from 0 to 1 and P_i is non linearly related to Z_i. The P_i is nonlinear not only in X but also in the β's as can be seen from Eq. 2. This means that we cannot use the familiar OLS procedure to estimate this parameter. If P_i is the probability of FDIoc impact on the environment and the people, given by Eq. 3, then (1-P_i) is the probability of being otherwise:

$$1 - P_i = \frac{1}{1+e^{z_i}} \tag{4}$$

Equation 4 can be re-written as:

$$\frac{P_i}{1-P_i} = \frac{1+e^{z_i}}{1+e^{-z_i}} = e^{z_i} \tag{5}$$

Note that $P_i/(1-P_i)$ is simply the odds ratio in favor of an issue occurring. The Logit model used can be explicitly specified as follows:

$$\text{Logit } (p/(1-p)) = (e^{\beta_0+\sum_{i=1}^{n}\beta_i x_i})/1+e^{\beta_0+\sum_{i=1}^{n}\beta_i x_i} \quad (6)$$

Logit regression or any other probability model such as probit is required to ensure the estimate of our dependent variable does not fall outside the range of 0 and 1. It is also in conformity with Occam's razor principle by keeping the regression model as simple as possible.

Logit model becomes necessary when there is need to keep the estimate of a dependent variable within the range of zero (0) and one (1). Hence it was adopted in this work since we intended to find out the probabilistic effect of FDI in oil on the environment and people of Niger Delta.

The above model can be specifically expressed in explicit econometric form as:

$$\text{Logit } (p/(1-p)) = (e^{\beta_0+\sum_{i=1}^{n}\beta_i x_i+\mu_i})/1+e^{\beta_0+\sum_{i=1}^{n}\beta_i x_i+\mu_i} \quad (7)$$

where, p is the probability of an event occurring, 1-p is the probability of an event not occurring, β_0 is the "intercept", β_i are the "regression coefficients" of the explanatory variables, n is the number of independent variables in each equation and μ is stochastic or random error term. The error term has the properties of zero mean and non-serial correlation. Thus, Eq 7 is used to estimate our model.

A logistic model is said to provide a better fit to the data if it demonstrates an improvement over the model consisting only intercept (this is also called the null model). An intercept-only model serves as a good baseline because it contains no predictors. Consequently, according to this model, all observations would be predicted to belong in the largest outcome category. An improvement over this baseline can be examined by using three inferential statistical tests: the likelihood ratio, score and Wald tests. All the three tests often yield similar conclusions (Menard, 2000). Therefore, likelihood ratio test was employed. The statistical significance of individual regression coefficient is tested using the t-statistic or z-statistic. Alternatively, probability value could be used such that a predictor is considered to be significant if $p<\alpha$ value of 0.05 except otherwise stated. Forecasting the probabilities given a set of values in the explanatory variable is given by:

$$\text{Logit } (p/(1-p)) = (e^{\beta_0+\beta_i x_i})/1+e^{\beta_0+\beta_i x_i} \quad (8)$$

Marginal effect (Odds ratio) and Combined Effect (Forecast Probability) as explained earlier, logistic regression predicts the logit of an event outcome from a set of predictors. Because the logit is the natural log of the odds (or probability/[1-probability]) it can be transformed back to the probability scale. The resultant predicted probabilities can then be revalidated with the actual outcome to determine if high probabilities are indeed associated with events and low probabilities with nonevents (Peng *et al*., 2002). The marginal effect is 'a probability' which ranges from zero (0) to one (1). The closer the result is to 1, the higher the probability of the event in question occurring.

DISCUSSION OF FINDINGS

The employment level has three independent variables, which are EP, COMP and PPA. Given the fact that likelihood ratio test (LR test) follows chi-square distribution, the estimated values of LR test are compared with the chi-square Table 1 value at 3 degrees of freedom and 5% level of significance. Since the LR (84.93179) is greater than the critical value (7.81473), we conclude that

Table 1: Summary of the results

Models	Variable	Coefficient	Std. error	Probability	Mean DEP.VAR.	LR. statistic	ODD. ratio	Combined effect
Employment	C	-403598	0.189693	0.0334				
	EP	2.388957	0.329818	0.0000	0.630178	84.93179	10.90212(EP)	0.8792513
	COMP	0.421472	0.276128	0.1269		7.81473(tab)		
	PPA	0.131625	0.265478	0.6200				
Health	C	0.479573	0.352905	0.1742				
	CHE	0.186004	0.342361	0.5869	0.822485	9.3431165	2.9714(FDIoc)	0.8275862
	FDIOC	1.089043	0.452877	0.0162		5.99147(tab)		
Education	C	-0.304031	0.180958	0.8093				
	EP	0.65738	0.243956	0.0070	0.588757	22.83613	1.92972(EP)	0.720035
	COMP	0.370891	0.242663	0.1264		7.81174(tab)	1.80631(PPA)	
	PPA	0.591286	0.234902	0.0118				
Income	C	0.356675	0.348466	0.3060				
	PPA	0.59923	0.243772	0.0140	0.630178	14.0442	I.82072(PPA)	0.8382395
	FDIoc	-0.374107	0.399322	0.3488		7.81473(tab)	1.9327(COMP)	
	COMP	0.658914	0.252473	0.0091				
Agriculture	C	0.236389	0.345396	0.4937				
	FDIoc	-0.883506	0.440431	0.0449			0.41333(FDIoc)	
	PPA	-0.042423	0.251689	0.8661	0.556213	40.01707	4.080477(EP)	0.992852
	EP	1.406214	0.258191	0.0000		11.0705(tab)		
	COMP	0.489123	0.254009	0.0542				
	CHE	0.14247	0.275227	0.6047				
Oil spillage	C	-0.980829	0.390868	0.0121				
	FDIoc	2.7400113	0.444817	0.0000	0.820896	58.83931	15.4872(FDIoc)	0.853107
	COMP	0.683164	0.392148	0.0815		5.99147 tab)		
Land degra.	C	-356675	0.348466	0.3060				
	Comp	31.97899	3031128	1.0000	0.908284	78.69432	21.558(FDIoc)	0.937853
	FDIoc	3.070767	0.467292	0.0000		(5.99147)tab		
Air pollution	C	-1.540445	0.449868	0.0006				
	COMP	34.10766	7433525	1.0000	0.872781	123.1781	50.3999(FDIoc)	0.915254
	FDIoc	3.919991	0.524615	0.0000		5.99147(tab)		

the model achieved high goodness of fit for the survey data. The proportion of the variations in the dependent variable explained by predictors in the model is approximately 63%.

Only employment provision for indigenes of the host communities (EP) by the oil companies has significant positive impact on the level of employment of the indigenes. Thus, we reject the null hypothesis for EP and conclude that the direct or indirect provision of employment for the indigenes by the oil companies has significantly positively impacted on the employment level of the indigenes. Although compensation payment made to the indigenes in case there is violation of their personal rights (COMP) and provision of public amenities to the communities (PPA) by the oil companies were found not to be statistically significant, they showed positive relationship with the employment level of the indigenes.

The odds ratio for indigenes to have employment is about 11 times higher than for general case. The probability of employment provision to the indigenes of the host communities (EP) by the oil companies to improve employment level of the indigenes is about 0.88. This indicates high probability of indigenes securing employment through oil companies' activities in the environment.

The health hazard is dependent on CHE and FDIoc. Comparing the estimated value of LR with the chi-square table value at 2 degrees of freedom and 5% level of significance, the LR (9.343165)

is greater than the critical value (5.99147), the model achieves a high goodness of fit. The proportion of the variations in the dependent variable explained by predictors in the model is approximately 82%.

Only foreign direct investment into crude oil in the communities (FDIoc) was found to have significant positive impact on the health hazard of the indigenes. Thus, we reject the null hypothesis for foreign direct investment in oil within the communities and conclude that the direct or indirect activities of the oil companies affect the health of the indigenes adversely. Although cost of health care (CHE) also has positive relationship with the level of diseases suffered by the indigenes, it was found not to be statistically significant.

The odds ratio for inhabitants falling sick as a result of foreign direct investment in crude oil in the communities (FDIoc) is about 3 times higher than the combined effect and the probability is approximately 0.83. This is of course on the high side.

Education is modeled to depend on EP, COMP and PPA. At 3 degrees of freedom and 5% level of significance, the LR (22.83613) is greater than the critical value (7.81473), so the model achieved a goodness of fit. The proportion of the variations in the dependent variable explained by the predictors in the model is approximately 60%.

Employment provision for the indigenes of the host communities by the oil companies (EP) and provision of public amenities to the communities by the oil companies (PPA) were found to have significant positive impact on the level of education of the indigenes of the host communities. Hence we reject the null hypothesis for Employment Provision (EP) and provision of public amenities by the oil companies to the communities (PPA) and accept that these two variables have positively affected the level of education of the indigenes. Although compensation payment made to the indigenes in case there is violation of their personal rights has positive relationship with level of education of the indigenes, it was found not to be statistically significant.

The odds ratio for indigenes' level of education to improve by employment provision and provision of public amenities by the oil companies in the host communities is about 2 times higher than the joint effect and the probability for these to occur is approximately 0.72. Thus, we reject the null hypothesis for EP and PPA and conclude that employment of the people and provision of public amenities for the communities by the oil companies have positively impacted on the level of education of the people.

Income of the indigenes is modeled to depend on PPA, FDIoc and COMP. At 3 degrees of freedom and 5% level of significance, the LR (14.04420) is greater than the critical value (7.81473), hence the model achieved a high goodness of fit. The proportion of the variations in the dependent variable explained by the predictors in the model is approximately 63%.

Provision of public amenities to the communities by the oil companies (PPA) and compensation payment made to the people in case there is violation of their personal rights were found to have significant positive impact on the level of income of the people. Therefore, we accept the hypotheses that these two variables have positively influenced the level of income of the indigenes. Although, foreign direct investment into crude oil in the communities has negative relationship with the level of income of the indigenes, it was found not to be statistically significant.

The odds ratio for indigenes' level of income to improve by provision of public amenities to the communities by the oil companies and compensation payment made by them to the indigenes in case there is violation of their personal rights is about 1.82 and 1.94 times, respectively, higher than the combined effect. The probability of having these outcomes is 0.83.

Also in our model, agricultural output is explained by FDIoc, PPA, EP, COMP and CHE. At 5 degrees of freedom and 5% level of significance, the LR (40.01707) is greater than table value (11.0705), implying that the model had a goodness of fit. The proportion of the variations in the dependent variable accounted for by the explanatory variables in the model is approximately 56%.

Foreign direct investment into crude oil in the communities (FDIoc) and employment provision to the indigenes of the host communities by the oil companies (EP) were found to have significant impact on the level of agricultural output. The former has a negative effect while the later has a positive effect. The later effect could probably be attributed to increased demand emanating from more employment of the indigenes which in turn encourage the local farmers to produce more. Other independent variables which are PPA, COMP and CHE were statistically insignificant. The odds ratio that FDIoc will reduce the indigenes' agricultural output and EP will improve the indigenes' agricultural output is about 0.41 and 4.10 times, accordingly, higher than the joint effect. The probability of achieving these results is 0.993, which is almost a certainty.

Accounting for the environmental factors using oil spillage, land degradation and air pollution, oil spillage is modeled to depend on FDIoc and COMP. At 2 degrees of freedom and 5% level of significance, the LR (58.83931) is greater than the table value (5.99147), meaning that the model achieved a high goodness of fit. The proportion of the variations in oil spillage explained by the two predictors in the model is approximately 82%. FDIoc was found to have significant positive impact on the level of oil spillage. In other words, as foreign direct investment into crude oil in the communities (FDIoc) increases, oil spillage increases. Thus, we reject the null hypothesis for FDIoc and accept that this variable increases the level of oil spillage in the community. Although COMP has positive relationship with oil spillage, it was statistically insignificant.

The odds ratio that FDIoc will increase oil spillage is 15.4872 times higher than the combined effect, the probability of this occurring is approximately 0.85.

Modeling land degradation, COMP and FDIoc remained our independent variables. At 2 degrees of freedom, the LR (78.69432) is greater than the table value (5.99147), implying that the model achieved a high goodness fit for the survey data. The proportion of the variations in land degradation explained by the predictors in the model is approximately 91%. FDIoc was found to have significant positive impact on the level of land degradation. That is, increase in foreign direct investment into crude oil in the communities (FDIoc) will increase the level of land degradation in the environment. Although COMP showed a positive relationship with the level of land degradation, it was statistically insignificant. The odds ratio that FDIoc increases land degradation is about 21.56 times higher than the joint influence. The probability of this occurrence is about 0.938.

Air pollution is also dependent on FDIoc and COMP. At 2 degrees of freedom and 5% level of significance, the LR (123.1781) is greater than the table value from (5.99147), which connotes that the model achieved a goodness of fit. The proportion of the variations in air pollution explained by FDIoc and COMP is approximately 87%. FDIoc was found to have significant positive impact on the level of air pollution. In other words, an increase in foreign direct investment into crude oil in the communities (FDIoc) will increase the level of air pollution in the environment. Although COMP exhibited a positive relationship with the level of air pollution, it was statistically insignificant. The odds ratio that FDIoc raises air pollution is about 50.4 times higher than the combined effect and the probability of this happening is about 0.92. This is of course on the high side. Thus, the probability of foreign direct investment into crude oil in the communities increasing air pollution is high.

CONCLUDING REMARKS

Oil exploitations have become a threat to the livelihoods of the Niger Delta people in Nigeria. Oil companies have left a trail of devastation indicated by polluted air and water that has continued to cause health hazards, destroy aquatic lives and farm lands. The livelihood sources and traditional occupations of the people are ruined, thereby fostering unemployment, underemployment, declining agricultural production, distorted social values as well as increase crime and violence. Implementation of the amnesty program has ushered in peace in the Niger Delta but the gains need to be sustained. FDI exploitation of the natural resources should be more effectively and responsibly managed in such a way that positive externalities will be generated for the local economies and livelihood, incomes and physical, social and economic development of the Niger Delta region. Government should device effective strategies or system to mitigate environmental problems. It should devote sufficient amount of fund to the maintenance the environment. Also create the necessary awareness as well ensuring that environmental policies and programmes are implemented.

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