# OIL AND GAS EXTRACTION AND CASSAVA OUTPUT IN ELEME LGA OF RIVERS STATE: A COMPARATIVE ANALYSIS OF MILITARY AND CIVILIAN GOVERNMENT IN NIGERIA

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***Abstract***

*The research investigated the effects of oil and gas extraction on cassava output in Eleme Local Government Area of Rivers State between 1986-1998 and 1999- 2011. An OLS regression equation was employed in conjunction with other econometric tests like ADF unit root test and Chow breakpoint test for comparative analysis. The regression results show that gas flaring and cassava seed planted negatively affected cassava output from 1986-1998 while oil spillage, gas flaring and land used for cultivation negatively affected cassava output from 1999-2011. The chow test confirms the inertia effect of the independent variables on the dependent variable. This was consistent with our a priori expectation that, increased oil spillage and gas flaring have negative economic consequences on output. Based on such findings, recommendations were made for the operators to use modern technologies of extraction, regular monitoring of oil production activities and facilities.*

Keywords Oil and Gas, Extraction, Cassava output, Eleme LGA, Rivers State

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## 1. Introduction

Nigeria is principally an agrarian economy which has continued to provide food for the teeming and fast growing population of the country, as well as a major source of employment to Nigerians and supplier of raw materials to the industrial sector, a provider of market for the products of industry and earns foreign exchange for the economy.

The National Bureau of Statistics (NBS) have recently indicated that agriculture currently contributes more to the GDP of Nigeria than any other sector of the economy. It is not yet clear whether the contributions of agriculture to GDP as established above by the National Bureau of Statistics is felt by the people of Eleme community whose major preoccupation before the discovery of oil was agriculture. This is as evidenced by the perennial food shortages and food price hike in the community. With the continued expansion of oil and gas extraction in the region, there is severe competition on access to land and other agricultural support resources like roads between oil companies and agricultural output. In essence, the extent of the effect of extraction of crude oil and gas in commercial quantity and the gloomy picture of agricultural output as painted by the NBS in Eleme community which hitherto was an agrarian community will be examined. This research will therefore carry out a comparative assessment of the effect of the extraction of oil and gas on the agricultural output of Eleme community between the military and civilian government between1986-2011.

### 1.1 Objectives of the Study

The specific objectives of the study are to:

1. investigate the relationship between oil and gas extraction and agricultural output in Eleme local government area.
2. conduct a comparative analysis between military and civilian regime output.

### 1.2 Research Hypothesis

$H_O$: There is no significant relationship between oil and gas extraction and agricultural output in Eleme Local Government Area.

### 1.3 Scope of the Study

This study will look at the effects of oil and gas extraction on cassava output in Eleme Local Government Area of Rivers State in Nigeria. Cassava is the major staple food crop in this area and the IFAD Cassava Programme started in the region since 1987 with the objectives of replacing the traditional cassava varieties with improved ones and increase its productivity, promote mechanical cassava processing technologies and promote multiplication of yam seed using the yam minisette technique. The choice of Eleme Local Government is justifiable because the community is one of the biggest amongst the Oil and Gas producing areas in the country. It is also one of the oldest communities where oil was discovered in Nigeria in commercial quantity with several major oil wells. The study covered a period of 26 years (1986 – 2011), covering both the military and civilian administration in Nigeria. Comparative analysis was done within this period which was disaggregated into 1986-1998 and 1999- 2011. The choice of this time frame indicates activities prior to the military transition to civilian administration.

## 2 Oil and Gas

Oil refers to crude oil and natural gas or simply put oil gas. Dennis (2000) defines oil as the mixture of various shapes and sizes, of hydrogen and carbon atoms found in the small connected pure space of some underground rock formations. These oil reservoirs are generally thousands of feet below the surface; crude oil is believed to be the remains of plants and animals, mostly small marine life, that lived many millions of years ago. Oil is discovered and produced through wells drilled down to the reservoirs. Experts such as Dennis (2000) agreed that from oil we can get numerous useful products such as transportation fuel, gasoline, diesel fuel, jet fuel etc. This definition has formed the basis for the understanding of oil and gas as a working definition for this work.

### 2.1 Oil Spillage

Ugochukwu (2008) defined oil spillage as an introduction of substances into the environment that alters its physical, chemical and biological properties in such a way that it becomes harmful to living organisms and soil. It is observed that whenever oil spill occurs, the soil, living organisms and plants within the spill region suffers. This implies that both oil extraction and spillage can cause adverse effect to the livelihood of the people if not properly and effectively conducted.

### 2.2 Agriculture

Agriculture is an industry or enterprise employing the knowledge of the various sciences and disciplines for the production of food, feed, fibre and fuel (Youdeowei, 1985). Its development is however becoming an increasingly complex phenomenon, particularly in developing countries like Nigeria, which has to aggressively produce food to equilibrate with the growth of the population. It is defined as the cultivation of land, raising and rearing of animals, for the purpose of production of food for man, feed for animals, and raw materials for industries (Anyanwu, 1993). It also involves forestry, fishing processing and marketing of these agricultural products. Essentially, it is composed of crops production, livestock, and fishing (Anyanwu, 1997).

### 2.3 Agricultural Output

According to Anyanwu *et al* (1997), agricultural output cannot be easily defined but rather explained. This is due to the fact that a variety of activities are involved in the production process and variety of outcomes is expected. Agricultural output is therefore the product of agricultural production. However, Dakare (2004) defined agricultural production as a continuous process of making conscious and systematic attempts of utilizing the agricultural resources of a country for the benefit of agricultural workers and farmers in particular and the entire economic population in general and agricultural output as the quantity of products derived from a production process. Just like in an organization, agricultural production entails a combination of input investment and output expectation. Abubi (2001) expanded the view when he contended that agricultural production is synonymous with rural transformation, that is, the structural change of an economy from pristine agricultural subsistence to investment dominated agriculture.

According to the World Bank (2007), agricultural output is measured in terms of total produce from agricultural investment while agricultural production is be measured in terms of food prices, food supply and the share of agriculture as a percentage of the GDP. The World Bank report called for greater investment in agriculture in the developing countries to avoid the impending consequences of hike in food prices and general hunger as they also constitute obstacles towards achieving MDGs.

In the context of this research work therefore, agricultural output refers to the total output of cassava produced while agricultural production refers to all activities relating to cassava

production while agricultural output refers to cassava output. The two can therefore be used interchangeably.

### 2.4 Sources of Oil Spillage and Associated Problems

According to Nwilo and Badejo (2005), the main sources of oil spillage in the entire Niger Delta region are: vandalization of oil pipelines by the criminals and local communities; ageing of the pipelines; oil blow outs from the flow stations; releases, both accidental and deliberate, from oil tankers on the high sea and the disposal of used oil into the drains by the roadside mechanics. By far the most serious source of oil spillage is through the vandalization of pipelines either as a result of civil disaffection with political process or as a criminal activity.

The entire Nigerian coast lines between Lagos and Port Harcourt and up to the Bakassi Peninsula have experienced recurrent oil spills. The beaches have often been polluted with tarballs (Asuquo, et al, 1995) which have reduced their potentials for recreational purposes. Beside water and land pollution, the oil industry has greatly contributed to the air quality particularly where some oil refineries and petrochemical industries have been concentrated. Gas flaring, petroleum fires from broken pipes and tankers have increased recently with certain effects on both humans and ecology. Other environmental problems caused by the oil industry include wanton destruction of vegetable in favour of installation of drilling equipment, pipelines and other constructions.

## 3. GAPSIM Model

GAPSIM is an acronym for a Systemic Dynamic Simulation Model (GAPSIM) which derived its name from the Southeastern Anatolian Project (GAP). The Model was designed to address the potential long-term environmental problems of the Southeastern Anatolian Project (GAP) on agricultural output in Southeastern Turkey by Saysel et al (1999). It was designed to analyze issues related to water resources, land use, land degradation, agricultural production, pollution and demography as they affect the people's economy from a systems perspective. The analysis focuses on the totality of environmental, social and economic consequences on the economy of the people. It belongs to the class of econometric input-output models and neoclassical approaches assuming bounded rationality. The models appear in the literature in two variants, empirically and theory based. Variables in the model can as well be adjusted to suite the purpose

for which the model is applied. In this work therefore, the model will be adjusted to include both the environmental, climatic and human factors influencing agricultural output in Eleme.

**4. Empirical Literature**

Nwilo and Badejo (2005) wrote on oil spill problems and management in the Niger Delta using descriptive statistics. The study identified oil spill as one of the major environmental challenges in the region which has affected their livelihood in all ramifications. The study recommended the need to create serious awareness among the populace on the implications of oil spill incidents on the environment. Also, the need for the government to assist the host communities in claiming their right of compensation was buttressed.

Douglasson (2006) examined the effect of oil spillage on crop yield and farm income in Delta State using a multiple regression models to estimate both crop yields and profit and Test of Differences of Means. The study revealed that oil spillage has caused severe reduction in crop yield thereby, reducing farmers' income and profit. The study recommended the enactment and enforcement of stringent environmental laws to protect the area as well as implementation of policies to reduce the crushing level of poverty and guarantee a better livelihood for the people.

Abii and Nwosu (2009) examined the effects of oil spillage on the soil of Eleme in Rivers State where ten soil samples were randomly collected at depth of 0-15cm and appropriate laboratory test conducted. The soil samples were excessively acidic which can be ascribed to the effect of oil spills. The study recommended regular monitoring of oil production activities and adequate compensation to the host communities.

From the foregoing, it is abundantly clear that no researcher has assessed the impact of oil and gas extraction on agricultural output of the people of Eleme. This research work would definitely fill this research and theoretical gap.

## 5. Data Sources

The study used only secondary time series data of agricultural input planted and output harvested by farmers in Eleme community. It also made use of data on oil spillage, water pollution and gas flaring as environmental factors while data on amount of rainfall in Eleme was used as a climatic factor. All these secondary sources of data were obtained from the State Ministries of Agriculture, Waters Resources and Environment in Rivers State.

### 5.2 Method of Data Analysis

Simple multiple regression analysis via e-views 6 statistical program was used to establish the relationship between oil and gas extraction and agricultural output. A comparative analysis was done between 1986-1998 and 1999-2011 to capture both the military and civilian effects of oil and gas extraction on agricultural output.

### 5.3 Specification of the model

The explicit form of the model was given as:

$$A_Q = \beta_1 + \beta_2 O_s + \beta_3 W_p + \beta_4 G_F + \beta_5 C_s + \beta_6 R_c + \beta_7 A_L + E_{it} \quad \ldots\ldots 1$$

Where:

$A_Q$ = Cassava Output in Eleme (measured in tones), $O_S$ = Oil Spillage in Eleme (measured in quantity of barrels), $W_P$ = Water Pollution (tones of water polluted from oil spillages), $G_F$ = Gas flared (measured in billion cubic meters), $C_s$ = Cassava Seed planted (measured in tones), Rc = Rainfall as a climatic factor (measured in millimeters), $A_L$ = Area of Cassava cultivation (hectares)

## 6. Analysis of ADF Test

Before estimating the OLS model between 1986 and 1998, the ADF test was performed. The result is presented in table 4.1 below:

**Table 1:** ADF Test (1986-1998)

| Variables | ADF Values at level | Mackinnon Critical value @ 5% | Order of Integration |
|---|---|---|---|

| | | | |
|---|---|---|---|
| $DA_{Q2}$ | -4.094999 | -3.175352 | 1(0) |
| $DO_s$ | -5.099169 | -3.144920 | 1(0) |
| $DW_P$ | -4.331656 | -3.144920 | 1(0) |
| $DG_F$ | -4.699425 | -3.144920 | 1(0) |
| $DC_s$ | -3.450148 | -3.144920 | 1(0) |
| $DR_c$ | -4.548809 | -3.259808 | 1(0) |
| $DA_L$ | -4.373953 | -3.175352 | 1(0) |

**Source:** Computed by the Authors.

The result of ADF between 1986 and 1998 contained in table 4.1 above shows that all the variables are stationary at levels. This means that the variables do not violate the stochastic assumptions of the OLS. This implies that result from OLS test will suffice to explain the relationship during this period.

**Table 2:** ADF Test (1999-2011)

| Variables | ADF Values at level | Mackinnon Critical value @ 5% | Order of Integration |
|---|---|---|---|
| $DA_{Q3}$ | -4.216126 | -3.144920 | 1(0) |
| $DO_s$ | -5.099169 | -3.144920 | 1(0) |
| $DW_P$ | -4.331656 | -3.144920 | 1(0) |
| $DG_F$ | -4.699425 | -3.144920 | 1(0) |
| $DC_s$ | -4.216192 | -3.144920 | 1(0) |
| $DR_c$ | -4.461558 | -3.175352 | 1(0) |
| $DA_L$ | -4.837283 | -3.144920 | 1(0) |

**Source:** Computed by the Authors.

The result of ADF between 1999 and 2011 presented in table 4.2 above shows that all the variables are stationary at levels. This means that the variables do not violate the stochastic assumptions of the OLS. This implies that result from OLS test will sufficiently explain the relationship during the period.

## 7. Analysis of OLS Regression Result

**Table 3:** Regression Results (1986-1998)

| $A_Q = f(0.030O_s + 225.5W_P - 98.25G_F - 0.878C_S + 3852R_C + 0.288A_L)$ | | | | | |
|---|---|---|---|---|---|
| *[2.135]* | *[2.360]* | *[-0.837]* | *[-0.486]* | *[1615]* | *[0.212]* |
| R-Squared | 0.897068 | Durbin Watson Stat | | 2.180319 | |
| Adj R-Squared | 0.77350 | | | | |

**Note:** *values in parenthesis in the regression equation are the t-statistic*

**Source:** Computed by the Authors

The result of table 4.3 indicates that during the period of 1986-1998, gas flaring and cassava seed input exerted negative influence on agricultural output in Eleme Local Government Area. Oil spillage did not exert negative influence contrary to *a priori* expectation. The estimated coefficient of oil spillage was however insignificant at 5% confidence level. Other variables in the model like rainfall, land input, and water pollution were positively related to agricultural output during the period under review.

The high $R^2$ of 0.897 indicate that over 89% of the total variations in agricultural output during the period of observation can be explained by the explanatory variables in the equation. This has attesting to a close linear relationship between the dependent variable and the independent variables. As would be expected, the Durbin-Watson statistics suggest the near absence of autocorrelation (DW= 2.18), but an examination of the explanatory variables will indicate the possibility of that.

**Table 4:** Regression Results (1999-2011)

| $A_{Q3} = f(-2.960O_s + 0.000W_P - 0.010G_F + 5.999C_S + 0.349R_C - 4.810A_L)$ | | | | | |
|---|---|---|---|---|---|
| *[-0.042]* | *[0.096]* | *[-1.097]* | *[23481]* | *[0.708]* | *[-0.913]* |
| R-Squared | 1.000000 | Durbin Watson Stat | | 1.989935 | |
| Adj R-Squared | 1.000000 | | | | |

**Note:** *values in parenthesis in the regression equation are the t-statistic*

**Source:** Computed by the Authors.

The analysis of table 4.4 indicates that during the period of 1999-2011, oil spillage, gas flared and land input exerted negative influence on agricultural output in Eleme Local Government Area. This result does not contradict our *a priori* expectation considering the fact that oil spillage and gas flared can cause a lot of damage on land meant for agricultural activities. This result further indicates that oil spillage and gas flared became uncontrollably detrimental to agricultural output during the civilian regime from 1999-2011 relative to 1986-1998. This result is consistent with the findings of Nwilo and Badejo (2005) and Douglasson (2006) who found out very severe negative effects of gas flared and oil spillage on farmers output in the entire Niger Delta region.

Water pollution, seed input and rainfall were positively related to agricultural output. Eleme is located within the mangrove swamp hence availability of rainfall for agricultural activities is not in doubt. Water pollution can easily affect aquatic lives but cannot easily does so with agricultural output as used in the context of this work.

The high $R^2$ of 1.000 indicate that 100% of the total variations in agricultural output during the period of observation can be explained by the explanatory variables in the equation thus, attesting to a linear relationship between the dependent variable and independent variables. Also, the Durbin-Watson statistics of 1.98 shows positive autocorrelation and within the normal bound.

**8. Analysis of the Chow Breakpoint Test**

Since it is a comparative analysis between two periods, there is need to conduct the Chow Test at specified breakpoints for the stability of the coefficients. The result for 1998 is presented in Table 4.5 below:

**Table 5:** Chow Breakpoint Test (1998)

| | | | |
|---|---|---|---|
| F-Statistic | 16.30876 | Prob. F(7, 11) | 0.0001 |
| Log Likelihood Ratio | 60.79271 | Prob. Chi-Square (7) | 0.0000 |
| Wald Statistic | 114.1616 | Prob. Chi-Square (7) | 0.0000 |

**Source: Computed by the Author, 2012**

The result of the Chow Breakpoint test shows that the coefficients are not stable. That is there are no breaks at specified points of 1986-1998 and 1999-2011. The test was conducted by comparing the value of the F-statistic with that of the probabilities at 5% confidence level. The value of 16.30876 is significant. This is supplemented by the high value of the log-likelihood ratio of 60.79271 which is also significant at 5% confidence level. The result implies that the effect of independent variables on the dependent variable was continuous. It is an inertia effect.

Again, the Chow Test at specified breakpoints for the stability of the coefficients for 1999 was conducted. The result is presented in Table 4.6 below:

**Table 6:** Chow Breakpoint Test (1999)

| | | | |
|---|---|---|---|
| F-Statistic | 11.05192 | Prob. F(7, 11) | 0.0003 |
| Log Likelihood Ratio | 52.08908 | Prob. Chi-Square (7) | 0.0000 |
| Wald Statistic | 77.36345 | Prob. Chi-Square (7) | 0.0000 |

**Source:** Computed by the Authors.

The result of the Chow breakpoint test shows that the coefficients are not stable. That is there are no breaks at specified points of 1986-1998 and 1999-2011. The test was conducted by comparing the value of the F-statistic with that of the probabilities at 5% confidence level. The value of 11.05192 is significant. This is supported by the high value of the log-likelihood ratio of 52.08908 which is also significant at 5% confidence level. The result implies that the effect of independent variables on the dependent variable was continuous from 1998 to 1999. It is an inertia effect that will remain continuous even in the long run and requires an urgent intervention.

## 9. Test of Hypothesis

Following the negative relationship between oil spillage and gas flared and agricultural output occasioned by oil and gas extraction in Eleme LGA, the $H_O$ is therefore accepted. The acceptance of the $H_O$ means, the signs of the coefficients of oil spillage and gas flared did not violate the a priori expectation. It automatically means the rejection of the alternative hypothesis of a significant relationship between oil and gas extraction and agricultural output in Eleme.

**10 Recommendations**

(a) The federal government as a matter of urgency, compel the oil multinationals to adhere to standard operational procedures for oil exploration and exploitation.

(b) Modern technologies of extraction should be adopted by operating companies to reduce the negative impacts of their activities on the people and environment.

(c) Communities should be properly informed and educated about any oil spills or any other ecological damage to avoid human disaster.

(d) There should be regular monitoring of oil production activities and facilities.

(e) Adequate compensation should be paid to the host and affected communities.

(f) The entire Niger Delta should be declared an ecological disaster area that is desirous of special attention and special rehabilitation measures.

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