

LINEAR REGRESSION ANALYSIS AND EVALUATION OF ENERGY PRODUCTION AND ITS IMPACT ON THE ECONOMY OF NIGERIA.

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ABSTRACT

This study first established a relationship between crude oil production and oil income using a linear regression analysis. By way of calibration, the article investigates quantity per barrel that must be produced annually to ensure an increase in Nigeria's oil revenues. The study also makes recommendations for in terms of policy formulations that would enable oil output increase, which would increase the country's economic ability to generate revenue.

Keywords: Energy, Production, Economy, Production, Revenue

INTRODUCTION

Nigeria is well-endowed with both unconventional and traditional energy sources. The non-conventional sources of energy are geo-thermal energy, biomass, oil shale, and sand (Iwayemi, 1998). The traditional sources of energy are crude oil, natural gas, coal, nuclear power, bitumen, and hydroelectricity.

Nigeria's primary energy source, crude oil, was discovered in 1956 with a 51,000 barrel per day (bpd) starting output (Akinosho, 1998). The oil boom era began in the 1970s, when outputs and earnings increased sporadically with crude oil contributing to approximately 70% of the overall commercial energy consumption and providing more than 90% of Nigeria foreign exchange income. (Okonkwo, 1998). In 1999, the crude oil output was 778,900 barrel while the earning was N 724,422.5 million (CBN, 1999).

However, despite the significant production and its position in foreign exchange earnings, Nigeria's crude oil production and earnings have been extremely erratic due to fluctuations in the global price of oil, frequent breakdowns of the petroleum refineries, and continuous oil production shuts down brought about by riots and protests in the oil-producing regions.

Based on the aforementioned scenario, it is predicted that Nigeria's crude oil production and oil revenues will improve if the government is capable of expanding its output and find a solution to the persistent issues with the refineries and sociopolitical instability that lead to shortages. The required quantity of crude oil that would consequently improve government revenue through oil earnings is therefore the concern of this paper.

The next section that follows provides a conceptual and empirical overview of oil production, its earnings and trends.

CONCEPTUAL ISSUES: ENERGY, OIL PRODUCTION, AND OIL EARNINGS

Ayodele (1998) referenced Kashkari (1975), conceives energy as the ability to carry out or accomplish tasks. This capability results from a variety of energy sources, which are categorized into convectional and non-convectional energy sources. The conventional energy sources are also grouped into renewable energy (such as hydro-electricity and wood fuels), and non-renewable energy (such as coal, lignite, crude oil etc); and non-conventional sources include gee-thermal energy, biomass, oil shale and sand, (Iwayemi, 1998).

However, of all the sources of energy, crude oil is the most dominant and important source of energy in Nigeria. Hawkins (1995) thus defined crude oil as the mineral oil found underground, refined for use

as fuel or in dry-cleaning, etc. some of the products from crude oil include diesel, kerosene, aviation fuel and petrol.

Emphasizing on its importance to economic development, Mcphail((2000) argues that crude oil makes significant contribution to the economic development of an endowed country because it generates sizeable revenues, creates jobs and business opportunities, and brings new roads and access to water and power to the remote rural areas in which they are typically located. Besides, they have the capacity to stimulate economic growth, reduce poverty, and raise living standards.

Ayodele (1998) further claims that in addition to serving as a pillar of wealth generation (via export and revenue earnings, GDP contribution, employment creation, etc.), it also functions as the hub of activity and the catalyst of growth for all sectors of the Nigerian economy. Okonkwo (1998) thus asserts that revenue from crude oil accounts for over 70% of Nigeria's national income, and in 1999 alone accounted for over 90% of foreign exchange earnings of the country, which translates to 76% (N724,422.5m) of the total federally collected revenue (CBN,1999). Nwokedi (1992) further emphasized the significance of this fact when he stated that Nigeria's substantial oil money serves as the foundation for its development spending. (Ojinnaka, 1998). Drawing instances from Equatorial Guinea The News Magazine (2002) cited the case of Malabo, the capital of Equatorial Guinea, which through oil earnings the city has witnessed transformation in office buildings, hotels and banking activities. Besides, the country's annual per capital GDP rose from \$500 in 1993 to \$2000 in the year 2002. Chad Republic that is categorized as a poor country by the World Bank will soon benefit from crude oil. The nation is anticipated to make billions of dollars, which it hopes will be used to enhance health, education and infrastructural services critical to an improvement in standard of living of its people. McPhail (2002) also cited the case of Papua New Guinea where the community schools, health clinics, water supply and sanitation have benefited largely from crude oil earnings.

TRENDS OF OIL OUTPUT AND REVENUES IN NIGERIA

Since the 1980s, the crude oil output has followed a fluctuating trend even though oil has constitutently contributed over 60% of the total Federally collected revenue. As shown in Table 1 from 1980 to 1989, total oil production has witnessed a series of fluctuations declining from 760,117 barrels in 1980 to 625,908 barrels in 1989. This decline in output is due partly to OPEC output control measures because of the global oil glut as well as civil disturbances in the oil producing areas which is induced by environment damages such as erosion, inundation, devegation, increased Stalinization of surface and ground water; and health risk associated with vector-borne diseases (Adeoye, 1998).

Conversely, during the 1990s, crude oil production witnessed a continuous increase with the exception of 1993 and 1994 when there was decline in oil production induced by the political crisis witnessed in the country. These fluctuations in output also affect the total oil earnings. For instance, the percentage contribution of crude oil to total Federal collected revenue declined from 81.0% in 1980 to 72.6% in 1989. This decline can be linked to the fluctuations in the world prices of oil experienced then. The invasion of Kuwait by Iraq in the early 1990s brought a brief near doubling in the nominal price of oil during the third quarter of 1990 which increases oil earnings in the nations that produce oil including Nigeria (Killick, 1993). While the decline witnessed in oil revenue in 1998 was attributed to the rise in OPEC crude oil supplies and the consequences of mild winter associated with the EL Nino phenomenal on the major oil consuming countries which exerted downward pressure on oil prices in 1998. (Iwayemi, 1998). Apart from these problems, a rise in oil production has continued to increase oil earnings.

Table 1: Production of crude oil and overall oil revenue in Nigeria (1980-1999)

Year Million)	production' (Million Barrel)	Total Fed Revenue ⁶ (N	Total Oil Earnings ^{0^} Million)	Ratio"
1980	760117	15233.5	12353.3	81.09
1981	525291	13290.5	8564.4	64.44
1982	470638	11433.7	7814.9	68.35
1983	450961	10508.7	7253.0	69.02
1984	507487	11253.3	8269.2	73.48
1985	547088	15050.4	10923.7	72.58
1986	535929	12595,8	8107.3	64.36
1987	483269	25380.6	19027.0	74.97
1988	529602	27596.7	19831.7	71.86
1989	625908	53870.4	39130.5	72.64
1990	660559	98102.4	71887.1	73.28
1991	689850	100991.6	82666.4	81.85
1992	711340	190453.3	164078.1	86.15
1993	691400	192769.4	162102.4	84.09
1994	696190	201910.8	160192.4	79.34
1995	715400	459987.3	324547.6	70.56
1.996	740190	520190.0	408783.0	78.58
1997	759710	585811.1	416811.1	71.52
1998	776190	463608.8	324311.2	69.95
1999	778900	949187.9	724422.5	76.32

Source: (a, b and c) CBN statistical bulletin 1999 and (d) computed by the author from (b) and (c).

DATA SOURCE AND METHODOLOGY

Data Source

Time series data for the period 1980-1999 on production of crude oil and crude oil revenues in Nigeria were used. The data were obtained from the Central Bank of Nigeria (CBN) Statistical Bulletin for the year 1999.

The Model

In specifying the model, emphasis is placed on whether crude oil production in Nigeria has a notable effect on its earnings. Since oil cannot on its own influence oil earnings other factors like socio-political factors are utilized as interaction variables between oil outputs and oil revenues.

Having established this link, the model is therefore formulated thus:

$$OP = f(OE, SPf) \dots\dots\dots (1)$$

With a linear relationship such as

$$OP = \beta_0 + \beta_1 OE + \beta_2 SPf + U \dots\dots\dots (2)$$

SPf = socio-political factors that determines the amount of oil outputs and oil revenues. Note that those factors are interactions variables that influences oil productions and revenues in Nigeria.

ao = intercept

a, and a? = the estimation parameters

U = disturbance term.

The a-priori expectations between dependant variable (oil productions) and the independent variables (oil earnings and socio-political factors) are:

$$\frac{\partial OP}{\partial OE} > 0; \frac{\partial OP}{\partial SPf} > 0$$

These indicate that as the quantity of oil production increases, the amount earned from oil will also increase, while a stable socio-political situation in the nation will lead to an increase in oil output. The tests are conducted at 5% level of significance.

EMPIRICAL RESULTS AND DISCUSSIONS

Table 2 presents the findings of the regression analysis.

Table 2: Regression Results of Oil Production and Oil Earnings in Nigeria.

Variables	Co-efficient Estimates
Intercept	591139
(t)	(9.03)
OE	0.43
(0)	(2-42)
SPf	-72142.4
(0)	(-1.03)
R ²	0.60
F	4.98

From the table, it shows that the model is fairly good since it has an R-Square of 60%. At 5% level of significance, the F-statistic shows that the model is beneficial in estimating the influence of oil output on oil revenues useful in on oil earnings, as the computed F-statistic which is 4.98 is greater than the tabulated F-statistic valued at 3.94.

For the individual variables the t-test at 5% level of significance showed that oil production is directly related to oil earnings thus satisfying our a-priori expectations.

In light of the model's outputs, the calibration analysis of oil production on oil earnings in Nigeria is presented thus.

$$OP = 591139 + 0.43OE - 72142.4SPf \dots\dots\dots(3)$$

Since our concern is to find out the impact of oil production on oil earnings, we therefore hold SPf constant.

Equation (3) then becomes:

$$OP = 591139 + 0.43OE \dots\dots\dots(4)$$

The appropriate (1 - oo) 100% prediction interval for OP when OE= OEP is $OP \pm t_{dj} SN^{\wedge}$ where the distribution oft is formed on (n-2) degree of freedom. The outcome of the calibration of the effect of oil production on oil earnings at 5,10,15 and 20 percents increase on the annual average of 632800 barrels of oil are presented in column 3 and 4 of Table 3.

Table 3: Calibration Results of oil Production and Oil Earnings.

Mean of the value of oil Production (632800 Barrels) per annum Level of value the of Oil Production (Barrels) (N Million) Point Estimate of 95% Prediction Interval Rise in Oil Revenue of Oil Earnings (N Million)

5% increase	664,440	876,848.2	876,838.3-896,858.1
10% increase	696,080	890,453.4	890,443.5-890,463.3
15% increase	727,720	904,055.6	904,045.7-904,065.5

20% increase 759,360 917,663.8 917,653.9-917,673.7

Source: Author's Computation

As shown in Table 3, the government will be required to increase oil production by about 664,440 barrels per year (i.e. 5% increase average value of oil production) to increase oil earnings by N876,848.2 million. At this rate there is a 95% confidence that government earnings from oil production will increase to between N876,835.3 million and N896,858.1 million. If the government decides to increase oil production by 20% of the annual average which represents 759,360 barrels, the amount of oil earnings will increase by N917,653.8 million. At this rate, there is a 95% confidence that government will earn between N917,653.9 million and N917,673.7 million.

RECOMMENDATIONS AND CONCLUSION

Having established a link between oil production and oil earnings in for Nigeria and the estimated rate of oil production that is needed to increase oil earnings, it is important to draw the attention of the government and oil producing companies on the need to put in place appropriate measures that would enhance the increase in oil production and at the same time increase oil earnings.

Therefore, the government should provide a freer rein to the private sector by providing it with a more flexible regulatory framework and infrastructural services that are critical to the production of oil.

Furthermore, oil production has potential environmental and safety risks, these need to be investigated and managed, although major oil companies do apply in-house standards and act as custodian for environmental concerns, there is need for a clean and transparent standard in the country. This would reduce civil disturbances that are induced by environmental problems which often lead to oil shortages, and consequently bring about an increase in oil production.

In addition, government should apart from paying adequate compensation to the host communities must ensure that benefits are equitably shared, not only between the government and oil companies but also between the host communities and the government. This would also bring the restiveness in these areas to a low level which consequently would give the oil producing companies' time to concentrate on oil production.

The new Niger Delta Development Commission [NNDC] should be well funded to provide projects that would meet local needs and build a sense of ownership among the rural communities in the Niger-Delta. The government should also honour its joint venture projects with oil companies by fulfilling its cash contribution.

Besides, a sinking fund should be created from where money would be released to execute the turn-around maintenance of the country refineries in order to ensure a throughout the year supply of oil products.

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