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STATISTICAL ANALYSIS OF OIL EXPORTS IN NIGERIA

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ABSTRACT: *This research article describes a study of the application of simple linear regression modeling techniques to Nigerian Oil Export between the periods of 2004-2013 obtained from statistical bulletin. Our result shows that there is a direct linear relationship between Oil Export(X) and Gross domestic product(Y). The coefficient of determination provided a good summary of the total variability explained by the chosen fitted model. We also observe that Oil export is statistically significant due to the fact that Oil export plays a key role in the economic growth of Nigeria. Hence the proposed model* $\hat{y}=58123.115+0.723x$ *is found to be adequate.*

KEYWORDS*:* Regression Analysis, forecasting, Oil Export, Modeling, Nigeria

INTRODUCTION

One of the main objectives of statistics is to forecast future levels of economic activities by studying the behavior of data in the past. However, oil export to Nigerian economy can firstly be appreciated from the perspective of export and economic development. It includes the total of crude oil products sold to other foreign countries. The aim of this paper is to develop a model for possible forecasting that will aid in decision making. However, a lot of researchers have shown renewed interest in the modeling using simple linear regression to model some physical and environmental problems. A few of these are: Amadi et al. (2016), Emerole and Georgine (2013), Fatoki et al. (2010), Nwachukwu and Egbulonu (2000), Nwankwo (2015), Oliver and Okpe (2015) Omran et al. (2015), Samaila (2013) and Shehu (2012). Regression analysis are perhaps the most commonly used forms of statistical analysis and are invaluable when making a large number of business and economic decisions Nwachukwu and Egbulonu (2000). However, several studied have been carried out in this area, hopefully, the present work can provide further insight, as this will widen the area of applicability of problem of this nature.

Materials and Method

The data for this study is a secondary data, obtained from CBN Statistics Bulletin between the period of 2000 – 2013.

Simple Linear Regression Models

For simple linear regression we wish to determine the relationship between a single independent variable X and a dependent variable Y. We assume that through functional relationship there is a straight line and may be describe by $Y = a + bx$. Where a is y-intercept and b is the slope of the line defined as the change in y for a unit change in Y or a unit change in X. The expected value of Y for each value of x is given E(Y/X) = a + bx, or E(Y) = a +bx. Suppose we have n pairs of observations (Y_1, X_1), (Y_2, X_2) … (Y_n, X_n) and wish to fix the module E(Y) = a + bx to the set of data points.

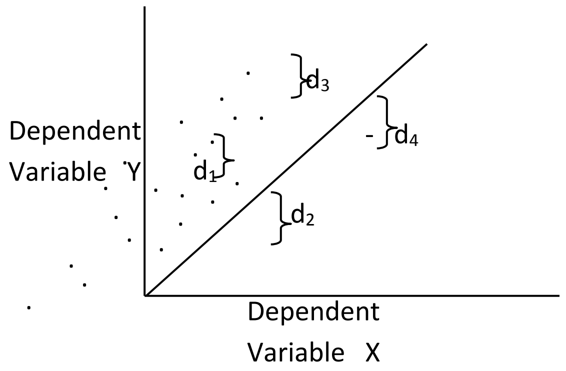

Figure 1: Scatter diagram of Simple Linear Regression

The convenient way to accomplish this and obtain estimated line with good properties is to minimize the sum of squares of the vertical deviations from the fitted lines.

Let $(\hat{Y}) = \hat{a} + \hat{b}x$ be the estimated line or an equation that describes the relationship between dependent and independent variable the predicted value at ith observation is $\hat{Y}_i = \hat{a} + \hat{b}x_i$. The deviation of the observe value of Y from $\hat{y}$ is $d_i = y_i - \hat{y}_i$, for convenient we may call it the deviation error and express it as $e_i = y_i - \hat{y}_i$.our interest is to minimize the sum of squares of the deviations.

i.e Min $\sum_{i=1}^{n} (yi - \hat{y}i)^2$ (2.1)

Let $L = \sum_{i=1}^{n} (yi - \hat{y}i)^2$ (2.2)

$$\frac{\partial L}{\partial \hat{a}} = O \ and \ \frac{\partial L}{\partial b} = 0 \quad (2.3)$$

$$L = \sum (yi - \hat{y}i)^2 \quad (2.4)$$

Min $\sum (yi - \hat{y}i)^2$ (2.5)

$$\frac{\partial L}{\partial a} = \frac{\partial \Sigma (yi - \hat{y})2}{\partial a} \quad (2.6)$$

$$\frac{\partial \sum_{i=1}^{n}\left(yi-\hat{a}+\hat{b}x_i\right)^2}{\partial \hat{a}} \quad (2.7)$$

$$2\sum_{i=1}^{n}\left(yi-\left(\hat{a}-\hat{b}x_i\right)(-1)=0\right. \quad (2.8)$$

$$-2\sum_{i=1}^{n}\left(yi-\hat{a}-\hat{b}x_i\right)=0 \quad (2.9)$$

$$\sum_{i=1}^{n}\left(yi-\hat{a}-\hat{b}x_i\right)=0 \quad (2.10)$$

$$\sum_{i=1}^{n}\left(y_i-\hat{a}-\hat{b}x_i\right)=0 \quad (2.11)$$

$$\sum_{i=1}^{n}y_i-\sum_{i=1}^{n}\hat{a}-\hat{b}\sum_{i=1}^{n}x_i \quad (2.12)$$

$$\sum_{i=1}^{n}yi-n\hat{a}-\hat{b}\sum_{i=1}^{n}x_i \quad (2.13)$$

$$\frac{\partial L}{\partial \hat{b}}=\frac{\partial \Sigma\left(yi-\hat{a}-\hat{b}x_i\right)^2}{\partial \hat{b}} \quad (2.14)$$

$$2\Sigma\left(yi-\hat{a}-\hat{b}x_i\right)(-x_i) \quad (2.15)$$

$$-2\Sigma\left(yi-\hat{a}-\hat{b}x_i\right)(x_i)=0 \quad (2.16)$$

$$\sum_{i=1}^{n}\left(yi-\hat{a}-\hat{b}x_i\right)x_i=0 \quad (2.17)$$

$$\sum_{i=1}^{n}\left(x_iy_i-\hat{a}x_i-\hat{b}x_i^2\right)=0 \quad (2.18)$$

$$\sum_{i=1}^{n}x_iy_i-\hat{a}\Sigma x_i-\Sigma x_1^2=0 \quad (2.19)$$

To solve for $\hat{b}$ multiply equ (2.14) by sum of x_i

Thus, we have $\Sigma x_i\,\Sigma y_i-n\hat{a}\Sigma x_i-\hat{b}(\Sigma x_i)^2=0$ (2.20)

$$n\Sigma x_i\,\Sigma y_i-n\hat{a}\Sigma x_i-n\hat{b}\Sigma x_i{}^2=0 \quad (2.21)$$

Subtracting (2.22) – (2.21) gives

$$n\Sigma x_i\,\Sigma y_i-\Sigma x_i\Sigma y_i-n\hat{b}\Sigma x_i{}^2+\hat{b}(\Sigma x_i)^2=0 \quad (2.22)$$

$$n\Sigma x_i\,\Sigma y_i-\Sigma x_i\Sigma y_i-\hat{b}\left(n\Sigma x_i{}^2-(\Sigma x_i)\right)^2 \quad (2.23)$$

$$\hat{b}=\frac{n\Sigma x_iy_i-\Sigma x_iy_i}{n\Sigma x_i^2-(\Sigma x_i)^2}$$

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From (2.21)

$$\Sigma x \Sigma y - \hat{b}(\Sigma x_i)^2 = n\hat{a}\Sigma x_i \qquad (2.24)$$

Divide through by $n\Sigma x_i$

$$\frac{\Sigma x \Sigma y - \hat{b}(\Sigma x_i)^2}{n\Sigma x_i} = \frac{n\hat{a}\Sigma x_i}{n\Sigma x_i} \qquad (2.25)$$

$$\frac{\Sigma y}{n} - \frac{\hat{b}\Sigma x_i}{n} = \hat{a} \qquad (2.26)$$

$$\hat{y} - \hat{b}x = \hat{a} \qquad (2.27)$$

$$\hat{a} = \hat{y} - \hat{b}\bar{x}$$

Or

$$\hat{a} = \frac{\Sigma x^2 \Sigma y - \Sigma x \Sigma xy}{n\Sigma x^2 - (\Sigma x)^2}$$

Inferences in Regression Analysis

$Y_i = \beta_0 + \beta_1 X_1 + \ldots + \beta_k X_{kj} + e_j$, Where j = 1,2, …, n

The residual estimate is given by $e_i = (y_i - \hat{y}_i)$.

The residual sum of squares (SS) is $\sum_{i=1}^{n} e_i^2 = \Sigma(y_i - \hat{y}_i)^2$

This can be shown to be equivalent to

$$\Sigma(y_i - \hat{y}_i)^2 = \Sigma(y_i - \bar{y}_i)^2 - \Sigma(y_i - \bar{y})\left[\hat{\beta}_1(x_{ij} - \bar{x}_1) + \hat{\beta}_2(x_{2j} - \bar{x}_2)\right]$$

$$= \quad \Sigma(y_i - \bar{y})^2 - \left(\hat{\beta}_1 \varsigma_{xiy} + \hat{\beta}_2 \varsigma_{x2y}\right)$$

Rearranging we have

$$\Sigma(y_i - \bar{y})^2 - (\beta_1 \varsigma_{x1y} + \hat{\beta}_2 \varsigma_{x2y} + \Sigma(y_i - \hat{y}_j)^2$$

Total SS = Regression SS + Residual SS

ESS is obtain by ESS = SYY - RSS

Table 1: ANOVA Table for Simple Linear Regression.

Source of Variation	Degrees of Freedom	Sum of Squares	Mean Squares	F – Ratio
Regression	K	SSR	MSR	F - $\frac{MSB}{MSE}$
Error or Residual	n - p	SSE	MSE	
Total	n – 1	SSY		

The coefficient of determination is given by $R^2 = 1 - \frac{SSE}{SST}$

An F – test is usually carried out to determine whether the overall regression of y on the independent variable is significant.

The Hypothesis are:

H_0: $\beta_1 = 0$

H_1: $\beta_1 \neq 0$

All analysis in this work was done using SPSS 20 statistical package.

RESULTS AND DISCUSSION

The key results that we have obtained in this research are presented in this section using the above-mentioned method of analysis

Table 2: Model Summary of Simple Linear Regression

Model	R	R Square	Adjusted R Square	Std. Error of the Estimate	Change Statistics					Durbin-Watson
					R Square Change	F Change	Df1	Df2	Sig. F Change	
1	.723[a]	.523	.463	186573.1860	.523	8.757	1	8	.018	2.698

a. Predictors: (Constant), Oil exports
b. Dependent Variable: Gross Domestic Product

Table 3: ANOVA table in testing for significance

Model		Sum of Squares	Df	Mean Square	F	Sig.
1	Regression	304833896914.164	1	304833896914.164	8.757	.018b
	Residual	278476429991.125	8	34809553748.891		
	Total	583310326905.289	9			

a. Dependent Variable: Gross Domestic Product
b. Predictors: (Constant), Oil exports

Table 4: Estimated Model Results

Model		Unstandardised Coefficients		Standardized Coefficients	T	Sig.	95.0% Confidence Interval for B	
		B	Std. Error	Beta			Lower Bound	Upper Bound
1	Constant)	58123.115	214474.787		.271	.793	-436456.630	552702.860
	Oil exports	.065	.022	.723	2.959	0.18	.014	.116

a. Dependent Variable: Gross Domestic Product

In table 2, R = 0.723 which indicates a high positive correlation, that is direct linear relationship between the GDP (y) and the oil exports (x). The coefficient of Determination (r^2) is 52% of the total variation in y is explained by the fitted model.

$H_o = \beta_1 = 0$ V_s $H_1 = \beta_1 \neq 0$

Reject Ho if $F_{cal} > F_{tab}$, V_1, V_2 and accept Ho otherwise from tables: f0.05, 1, 9 = 5.12

Decision rule: Since $F_{cal} = 8.757$ is greater than $5.12 = f_{tab}$, we reject H_o that $\beta 1 = 0$ at the 5% level of significance. Therefore, we conclude that there is underlying linear relation and hence oil exports (x) is useful as a predictor of GDP(y).

In table 3, we observed that $\beta = 58123.115$ which implies that if the independent variable (oil export) is held constant, the dependent variable (GDP) will increase by 58123.115 units. Hence the fitted model is given as $\hat{y} = 58123.115 + 0.723x$. The independent variable (oil export) is statistically significant; this is due to the fact that oil exports play a key role in the economic growth of Nigeria. This result agrees with work of Amadi et al (2010).

However, we can be 95% confident that the slop of regression line is somehow between .014 and .116 (see table 4).

CONCLUSION

We have used the technique of SPSS 20 software packages to analyze the relationship of oil Export on economic growth in Nigeria. In particular, we have observed that Oil Export is statistically significant in terms of economic growth. This research has provided the basis for Nigerians not to compromise with any person or group of persons who may jeopardize the serious effort of federal Government in respect to Oil Export in Nigeria. We shall be looking at the effectiveness of the fitted model in our next study.

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