APPLICATION OF REGRESSION ANALYSIS ON MONTHLY SALES OF CRUDE OIL

(A CASE STUDY OF CENTRAL BANK OF NIGERIA FROM 2006-2024)

BY

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HND/23/STA/FT/0062

BEING A RESEARCH PROJECT SUBMITTED TO THE DEPARTMENT OF STATISTICS,

INSTITUTE OF APPLIED SCIENCES,

KWARA STATE POLYTECHNIC, ILORIN.

IN PARTIAL FULFILLMENT OF THE REQUIREMENTS FOR THE AWARD OF HIGHER NATIONAL DIPLOMA (NHD) IN STATISTICS

JULY, 2025

CERTIFICATION

I certify that this project was carried out by OGUNDIRAN BARAKAT ADENIKE with matriculation number HND/23/STA/FT/0062 as meeting the requirement for the award of Higher National Diploma in the department of Statistics, Kwara State Polytechnic, Ilorin.

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DEDICATION

This research work is dedicated to Almighty God who has seen me through from the beginning to the end of the course. And to my lovely parents who has always been supportive

ACKNOWLEDGMENTS

First and foremost, I give all glory to God Almighty for his grace, strength and guidance throughout the course of this project.

I sincerely express my deepest gratitude to my supervisor MRS. YUSUFF, G.A, for her constant support, valuable insights, and constructive guidance, which contributed immensely to the success of this work.

To my wonderful parent MR &MRS OGUNDIRAN i want to say a very big thank you to you both, I know you are super proud of me thank you so much for your sacrifice your prayers, encouragement, and sacrifices have been my backbone throughout the academic journey, I'm grateful.

To my UNCLE(MR QUADRI) I am grateful for your support and love throughout my journey, I want to say a very big thank you to you sir I'm very grateful to you once again thank you so much sir may you continue to prosper In Sha Allah

To my siblings (ADEBAYO and DAMILARE) thank you for believing in me thank you for your support and love throughout the journey.im so grateful to you guys and I promise to always be there for you both any day anytime

My sincere gratitude also goes to the Head of Statistics Department, in person of Miss Elepo T.A,and all the lecturers of Statistics Department, Kwara State Polytechnic, Ilorin in person of Dr. (Mrs.) Aiyelabegan, A.B; Dr olarinoye: Mr. Yusuff, K.N; Miss Ajiboye, R.A; Dr. Beki, D.O; Mr. Shafihi, F.G; Mr. Kuranga, J.O; Yusuf Saad; Mrs. Yusuf, G.A; Mrs. Abdulrahman; for the good academic support given since the beginning of our program till point on time.

To my loving family, thank you for your prayer, encouragement, and unwavering support, even during challenging times. I would also like to appreciate my friends, classmates for the moments of laughter, teamwork, and shared growth throughout this journey .

Finally I am grateful to everyone who contributed, directly or indirectly, to completion of this project. Your support means more than words can express Finally, I dedicate this work to every young woman striving to rise above challenges, pursue her dreams, and walk in purpose. This is for us

ABSTRACT

This project work studies the contributions of crude oil price and crude oil export on crude oil production in Nigeria. Secondary data was used for the study. The data was sourced from the statistical bulletin of Central bank of Nigeria (CBN) within the year 2006-2024 – a nineteen year period. Analysis was carried out using multiple linear regression. The findings of the study indicate that there exists no Multicollinearity problem in the data set since the value of VIF obtained (1.012) is less than 10 and the value of Tolerance is far away from zero. The model obtained is thus $Crude\,Oil\,Export = -0.450 + 3.497E - 18\,Crude\,Oil\,\Pr ice + Crude\,Oil\,\Pr oduction$ *. The value of Adjusted R-Square obtained shows that 100% of the Crude Oil Export has been accounted for by the Crude oil Production and Crude Oil Price. The value of multiple correlation coefficient R obtained implies that the model is adequate since the value is 1. The study recommends that government should fight corruption by establishing institution that will arrest and prosecute corrupt public office holders and sinking fund should be created from where money would be released to execute the turnaround maintenance of the country refineries in order to ensure a throughout the year supply of oil products and maintain a lead in crude oil production.*

Keywords: Crude oil Production, Crude Oil Export, Crude Oil Price, Multiple Linear Regression, Multicollinearity, VIF, Tolerance Value

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CHAPTER ONE

INTRODUCTION

1.1 Background to the study

Oil is a major source of energy in Nigeria and the world in general. Oil being the mainstay of the Nigeria economy plays a vital role in shaping the economic and political destiny of the country. Although Nigeria's oil industry was founded at the beginning of the century, it was not until the end of the Nigeria civil war (1967 – 1970) that the oil industry began to play a prominent role in the economic life of the country. Nigeria can be categorized as a country that is primarily rural, which depends on primary product exports especially oil products. Since the attainment of independence in 1960 it has experienced ethnic, regional and religious tensions, magnified by the significant disparities in economic, educational and environmental development in the south and the north. These could be partly attributed to the major discovery of oil in the country which affects and is affected by economic and social components.

Crude oil discovery has had certain impacts on the Nigeria economy. Although large proceeds are obtained from the domestic sales and export of petroleum products

Crude oil is one of the natural resources to mankind and a major source of energy in Nigeria. It is a vital commodity in world market despite the campaign for green energy and other sources of power. Crude oil is one of the expensive commodities in the international market. Nigerian economy is heavily dependent on crude oil. The United States remains Nigeria's largest customer for crude oil, accounting for about 40% of the country's total crude oil exports. (Nwogu, 2010).

The history of oil exploration in Nigeria dates back to 1907 when Nigerian Bitumen Corporation conducted exploratory work in the country; however, the firm left the country at the onset of World War I. Thereafter, a new license covering 357,000 sq. miles was given to a new firm called Shell D'arcy Petroleum Development Company of Nigeria. The new firm was a consortium of Shell and British Petroleum (then known as Anglo-Iranian). Shell-BP in the pursuit of commercially available petroleum found oil in Oloibiri, Nigeria in 1956. Production of crude oil began in 1957 and in 1960, a total of 847,000 tonnes of crude oil was exported. After that, the economy of Nigeria should have seemingly have experienced a strong increase. In the 70s, Nigeria realised enormous revenue from crude oil, which was regarded as oil boom. As a result of the tremendous revenue realized from crude oil, other exploration companies were attracted to the industry (Udosen et al, 2009). Nigeria was able to reap instant riches from its oil production (Odularu,2008). Also, NNPC report had it that Nigeria petroleum industry is the main generator of Gross domestic product (GPD) with statistics that oil revenue has totalled $ 340 billion in exports since the 1970s. With this great achievement in the oil sector, government concentrated solely on oil for foreign exchange earnings lead to the neglect on agriculture which had been the source of revenue to the country.

In 2000, oil and gas exports accounted for more than 98% of export earnings and about 83% of federal government revenue, as well as generating more than 14% of its GDP. It also provides 95% of foreign exchange earnings, and about 65% of government budgetary revenues. Nigeria's proven oil reserves are estimated by the United States Energy

Information Administration (EIA) at between 16 and 22 billion barrels (3.5×109 m3), but other sources claim there could be as much as 35.3 billion barrels (5.61×109 m3). Its reserves make Nigeria the tenth most petroleum-rich nation, and by the far the most affluent in Africa. In mid-2001 its crude oil production was averaging around 2.2 million barrels (350,000 m^3) per day. It is expected that the industry will continue to be profitable based on an average bench mark oil price of $85-$90 per barrel.

As recently as 2010, Nigeria provided about 10% of overall U.S oil imports and ranked as the fifth-largest source for oil imports in the U.S. However, Nigeria ceased exports to the US in July 2014 because of the impact of shale production in America; India is now the largest consumer of Nigerian oil. There are six petroleum exportation terminals in the country. Oil companies in Africa investigate offshore production as an alternative area of production. Angola and Nigeria are the largest oil producers in Africa. In Nigeria, the deep-water sector still has a large avenue to expand and develop. The Agbami oilfields hit full production in 2005, at 250,000 barrels a day. The amount of oil extracted from Nigeria was expected to expand from 15,000 bbl/d (2,400 m_3/d) in 2003 to 1.27 Mbbl/d (202,000 m_3/d) in 2010.

Nigeria being a mono- product economy that relies on the income generated from crude oil for day to day running of governmental functions, provision of infrastructure and other social amenities for the citizenry but the income generated depends on the quantity of crude oil produced as well as the price per barrel. Therefore, it is necessary to provide a fitted model that can be used to forecast quantity of crude oil produced for the purpose of making reliable budget for the sustenance of the economy.

1.2 Statement of the problems

Crude oil is very expensive to bring under control when monetary policy is used to show aggregate demand.

The problem of crude oil production in Nigeria is particularly not worthy. It is disturbing to observe that with Nigeria as one of the most oil country in the world, crude oil and other related oil product should not be a problem to the country. So, this research intends to fit an appropriate fitted model of crude oil production in Nigeria from (2006-2020) and to make reasonable recommendations on the result obtained.

1.3 Aim and Objectives

The aim of this project work is to study the relationship that exists among the crude oil export, crude oil price and crude oil production for the year 2006-2024. The aim is going to be achieved through the following objectives:

i. to determine the degree of relationship that exists among the selected variables;

ii. to fit a regression model;

iii. to test for the significance of the model;

iv. to determine if there exists multicollinearity problem in the data set; and

v. to test for the normality of the residual

1.4 Significance of the study

This project will serve as reference for more finding on how to tackles the problem of crude oil export in Nigeria and for subsequent researchers who intent to carry out studies related to this topic. It helps in effort to shed more light on the price and export on production of crude oil in Nigeria.

1.5 Scope of the study

The scope for any research work is usually discovered in order to give account to the extent of its inference. For this particular research the scope is restricted to the monthly production of crude oil, crude oil price and crude oil export in Nigeria between 2006 -2024 and fit a model that can be used for future prediction.

1.6 Sources of the data

The data used for this research was sourced from the Central bank of Nigeria Bulletin and the data is secondary since the method of collecting the data is documentary. The data was recorded in their daily register covering 228 months (19 years) from 2006-2024.

CHAPTER TWO

LITERATURE REVIEW

The link between crude oil exports and economy growth has attracted the attention of the researchers and scholars. The approaches of the examination of this topic have been taking several dimensions by different scholars.

The issue under review is a vital subject that should be subjected to painstaking empirical review in order to keep abreast with the positions of the concerned researchers and scholars on this subject and to determine the gap inherent in the earlier related studies.

Nwoba & Abah (2010) conducted a study to examine the impact of crude oil revenue on the growth of the Nigerian economy between 1960 and 2010. The method of data analysis was the ordinary least square (OLS) regression analysis. The result of the finding stated there is long run relationship between crude oil proceeds and Gross domestic product (GDP). The findings revealed the extent of economic growth impacted by the oil industries was significant.

Awujola, Adam & Alumbugu (2015) in their study conducted, examines the economic impact of oil exportation on Nigerian economy covering a period of 1970 to 2012. Vector error correction model was analysis the data. The result obtained from our empirical analysis shows that there exist a long run relationship between the crude oil exports and the economic growth. The conclusion of the study is that Exports should not be promoted at all cost, but rather the utilization and allocation of the physical resources and labor complement of the country in the most advantageous combination as between production for the local and foreign markets and that diversification should be seen as an economic management strategy aimed at ensuring stability of incomes.

Kawai, (2016) conducted a study to investigate the specific impact of the non-oil exports to the growth of Nigerian economy using annual data between 1980-to-2016. The method of data analysis was multiple regressions. The study, apart from empirically providing information that has failed to give backing to recent claims of non-oil exports led growth in Nigeria.

Odularu (2008) carried out a study titled Crude Oil and the Nigerian Economic Performance. The aim of the study was to ascertain the impact of crude oil on the Nigerian economy. The study analyzed the relationship between the crude oil sector and the Nigerian economic performance using the Ordinary Least Square regression method. The study found that crude oil consumption and export have contributed to the improvement of the Nigerian economy. The study conclude that the production of crude oil (domestic consumption and export) despite its positive effect on the growth of the Nigerian economy has not significantly improved the growth of the economy, due to many factors like misappropriation of public funds (corruption) and poor administration.

Usman, Madu and Abdullahi (2015) carried out a study titled Evidence of Petroleum Resources on Nigerian Economic Development (2000-2009). The main objective of the study was to examine the impact of petroleum on Nigeria's economic development. The time series variables were two, that is, crude oil Revenue and the Gross Domestic Product GDP. The tool of analysis used was simple linear regression model with the aid of

Statistical Packages for Social Sciences (SPSS). The study found that petroleum has a direct and positive significant relationship with the economy.

Eravwoke, Alobari and Ukavwe (2014) carried out a study titled Crude Oil Export and its Impact in Developing Countries: A Case of Nigeria. The objectives of the study centered on an empirical investigation of crude oil export and it impact on growth of the Nigerian economy. The study used ordinary least squares regression method, Augmented Dickey Fuller unit root, cointegration test and the short run dynamics. The study found that there was an inverse relationship between crude oil exports on economic growth in the Nigerian economy. This implies that crude oil exports are a significant factor that can transform the growth of an economy. The study also found that there was a significant relationship between crude oil exports of the Nigeria economy.

Baghebo and Atima (2013) carried out a study on the Impact of Petroleum on Economic Growth in Nigeria and data covering the period 1980-2011 Oil revenue on the other hand impacted negatively and significantly on Real GDP. A unit change in Oil revenue brings about a fall in GDP. The results indicate that a unit change in oil revenue result to 1.362996 reductions in GDP. This means that the Dutch disease phenomenon exist in Nigeria.

Ogbonna and Appah(2012) carried out a study on the Petroleum Income and Nigerian Economy: Empirical Evidence. The main objective of the study was to ascertain the effects of petroleum income on the Nigeria economy. The study investigated the effects of petroleum income on the Nigerian economy from the year 2000 to 2009 using the gross domestic product (GDP), per capita income (PCI), and inflation (INF) as the explained variables, and oil revenue, petroleum profit tax/royalties (PPT \R), and licensing fees (LF) as the explanatory variables. The study found that oil revenue has a positive and significant relationship with GDP and PCI, but a positive and insignificant relationship with INF. Similarly, PPT/R has a positive and significant relationship with GDP and PCI, but a negative and insignificant relationship with inflation. It was also found that LF has a positive but insignificant relationship between GDP, PCI and INF, respectively. Based on these findings, the study concluded that petroleum income (oil revenue and PPT/R) had positively and significantly impacted the Nigerian economy when measured by GDP and PCI for the period 2000 to 2009.

Akinlo (2012), carried out a study on How Important is Oil in Nigeria's Economic Growth? The study assessed the importance of oil in the development of the Nigerian economy over the period 1960-2009. The study used secondary data.

CHAPTER THREE

RESEARCH METHODOLOGY

3.1 Regression Analysis

Regression analysis was first developed by Sir Francis Galton in the latter part of the 19^{th} century. Galton developed a mathematical description of the regression model. Regression analysis serves three major purposes which are description, control and prediction.

Regression analysis is a statistical tool for the investigation of relationship between variables. Usually, the investigation seeks to ascertain the causal effect of one variable upon another.

Regression technique has long been central to the field of economic statistics ("Economist"). Investigations in which the relationship between a single regressor or explanatory variable X and a response of dependent variable Y is of interest is called a simple linear regression. If however, the interest of the investigator is a single dependent variable Y that depends on K independent variable for example $X_1, X_2, ..., X_k$, then we talk of a multiple linear regression.

3.2.1 Multiple Linear Regression

Many regression problems involve more than one explanatory variable. The general purpose of multiple regression is to learn more about the relationship between several independent or predictor variables and a dependent variable. The prediction equation is obtained by using the least square procedure to evaluate the necessary coefficient in the assumed equation. We assumed the theoretical equation of the form of equation 3.1.

$$Y_i = \beta_0 + \beta_1 X_{i1} + \beta_2 X_{i2} + ... + \beta_k X_{ik} + \varepsilon_i \qquad (3.1)$$

where, β_0 = the regression constant

β_1 = the regression coefficient for variable X_1

β_k = the regression coefficient for variable X_k

k = the number of independent variables.

ε_i = the residual (error term).

Assumptions about the error term ε are as follows:

i. they are independent;

ii. have mean of zero and a constant variance of σ^2 for any set $X_1, X_2, ..., X_k$; and

iii. are normally distributed

When the assumptions about ε are met, the average value y for a given set of value $X_1, X_2, ..., X_k$ is equal to the deterministic part of the model;

$$Y_i = \beta_0 + \beta_1 X_{i1} + \beta_2 X_{i2} + ... + \beta_k X_{ik} \quad i = 1,2, \ldots, n$$

(3.2)

3.2.2 Matrix Approach to Estimating Multiple Linear Regression Coefficients

In fitting a multiple linear regression model, it is much more convenient to express the mathematical operations using matrix notation. Suppose that there are *k* regressor variables and n observations, $(X_{i1}, X_{i2}, ..., X_{ik}, Y_i)$ i = 1, 2, … , n and that the model relating the regressors to the response is as shown in equation 3.2.

$$Y_i = \beta_0 + \beta_1 X_{i1} + \beta_2 X_{i2} + ... + \beta_k X_{ik} + \varepsilon_i,\ i = 1,2,...,n \quad (3.3)$$

This model is a system of n equations that can be expressed in matrix notation as

$$Y = X\beta + \varepsilon$$

(3.4)

where

$$y = \begin{pmatrix} y_1 \\ y_2 \\ \vdots \\ y_n \end{pmatrix} \qquad X = \begin{pmatrix} 1 & x_{11} & x_{12} & \cdots & x_{1k} \\ 1 & x_{21} & x_{22} & \cdots & x_{2k} \\ \vdots & \vdots & \vdots & \vdots & \vdots \\ 1 & x_{n1} & x_{n2} & \cdots & x_{nk} \end{pmatrix} \quad \beta = \begin{pmatrix} \beta_0 \\ \beta_1 \\ \vdots \\ \beta_k \end{pmatrix} \quad \text{and} \qquad \varepsilon = \begin{pmatrix} \varepsilon_1 \\ \varepsilon_2 \\ \vdots \\ \varepsilon_n \end{pmatrix}$$

(3.5)

In general, Y is an (n x 1) vector of the observations, $\boldsymbol{X}$ is an (n x k) matrix of the levels of the independent variables, β is a (k x 1) vector of the regression coefficients, and ε is an (n x 1) vector of random errors.

However, the resulting equation that must be solved is

$$X'XX'Y \quad (3.6)$$

To solve the normal equations multiply both sides by the inverse of $X X$. Therefore, the least squares estimate of β is

$$\hat{\beta} = (X'\mathrm{X})^{-1} X'\mathrm{Y}$$

(3.7)

Note that there are $p = k + 1$ normal equations in $p = k + 1$ unknown (the values of β_0, β_1 ,... β_k). For instance, if we have two predictors (i.e. k = 5), we will have three equations in three unknowns (β_0, β_1, β_2, β_3, β_4, β_5). The procedures are as follows:

The matrix of the predictor variables is:

$$X = \begin{pmatrix} 1 & x_{11} & x_{21} & x_{31} & x_{41} & x_{51} \\ 1 & x_{12} & x_{22} & x_{32} & x_{42} & x_{52} \\ . & . & . & . & . & . \\ . & . & . & . & . & . \\ . & . & . & . & . & . \\ 1 & x_{1n} & x_{2n} & x_{3n} & x_{4n} & x_{5n} \end{pmatrix}$$

(3.8)

The vector of dependent variable is:

$$y = \begin{pmatrix} y_1 \\ y_2 \\ \vdots \\ y_n \end{pmatrix} \tag{3.9}$$

Then the design matrix is:

$$X'X = \begin{pmatrix} n & \sum_{i=1}^{n} x_{i1} & \sum_{i=1}^{n} x_{i2} & \sum_{i=1}^{n} x_{i3} \\ \sum_{i=1}^{n} x_{i1} & \sum_{i=1}^{n} x_{i1}^2 & \sum_{i=1}^{n} x_{i1}x_{i2} & \sum_{i=1}^{n} x_{i1}x_{i3} \\ \sum_{i=1}^{n} x_{i2} & \sum_{i=1}^{n} x_{i1}x_{i2} & \sum_{i=1}^{n} x_{i2}^2 & \sum_{i=1}^{n} x_{i2}x_{i3} \\ \sum_{i=1}^{n} x_{i3} & \sum_{i=1}^{n} x_{i1}x_{i3} & \sum_{i=1}^{n} x_{i2}x_{i3} & \sum_{i=1}^{n} x_{i3}^2 \end{pmatrix} \tag{3.10}$$

The vector of observations is:

$$X'Y = \begin{bmatrix} \sum_{i=1}^{n} y_i \\ \sum_{i=1}^{n} x_{i1}y_i \\ \sum_{i=1}^{n} x_{i2}y_i \\ \sum_{i=1}^{n} x_{i3}y_i \end{bmatrix} \tag{3.11}$$

Then the vector of parameters is defined as

$$\hat{\beta} = \begin{bmatrix} \beta_0 \\ \beta_1 \\ \beta_2 \\ \beta_3 \\ \\ \\ \end{bmatrix} = \left(X'X\right)^{-1} X'Y$$

(3.12)

3.2.3 ANOVA in Multiple Linear Regressions

The ANOVA in multiple linear regression is interested in analyzing the variation in dependent variable Y into its component parts; one part due to relationship with $(X_{i1}, X_{i2}, ...X_{ik})$ and the other parts due to error. The general form of the ANOVA table for a multiple regression is shown in table 1 below.

Table 3.1: Analysis of Variance for Testing Significance of Regression in Multiple Regression

Source of Variation	Sum of Squares	Degrees of Freedom	Mean Square	F_{cal}
Regression	$SS_R = \hat{\beta}'(X'y) - n\bar{y}^2$	k	$MS_R = SS_R / k$	MS_R / MS_E
Residua(Error)	$SS_E = SS_T - SS_R$	$n-k-1$	$MS_E = SS_E / n-k-1$	

Total	$SS_T = y'y - n\bar{y}^2$	$n-1$

The ANOVA is usually applied in multiple regression analysis to test for the significance of all the regression coefficients. The hypothesis for ANOVA in multiple regression is as follows:

Hypothesis

$H_0 : \beta = 0$

$H_1 : \beta \neq 0$

Test Statistic

$$F_{cal} = \frac{MSR}{MSE}$$

Decision Criterion:

Reject H_0 if $F_{cal} > F_{\alpha,k,n-k-1}$ for α level of significance; where k is the number of explanatory variables in the model. But in this research, H_0 will be rejected if the p value (significant value) is less than the pre-selected level of significance *(p-value < 0.05)*.

3.2.4 Coefficient of Multiple Determination

The coefficient of multiple determination (R^2) measures the proportion of the total variation in the value of the dependent variable y that is explained by variation in the independent or explanatory variable $X_1, X_2, .., X_k$ when multiplied by 100, this proportion is converted to percentage. Computationally it's given by

$$R^2 = \frac{SSR}{SST} = 1 - \frac{SSE}{SST} \quad (3.13)$$

3.2.5 Adjusted value of R^2

Since R^2 can be artificially inflated by the inclusion of more explanatory variables, it can be difficult to judge whether the increase is telling us anything useful about the regressor. It is particularly hard to interpret a small increase. Hence, many regression users prefer to use an adjusted R^2 statistic:

$$R^2_{adj} = 1 - \frac{SSE / n - p}{SST / n - 1} \tag{3.14}$$

3.2.6 Test for Significance of Regression Coefficient

To know which of the regression coefficient are different from zero and thus useful for predictions. The next step is to test the variables individually to determine which regression coefficient may be zero and which are not. If β could be zero it implies that this particular independent variable is of no value in explaining variations in the dependent variable. The test is performed using

$$t_{cal} = \frac{\beta_i}{S.E(\beta_i)}$$

(3.15)

where

β_i is the estimate of the regression coefficient for variable X_i and

$S.E(\beta_i)$ is the standard error of β_i.

H_0 is to be rejected if $|t_{cal}| > t_{\alpha/2, n-p}$, otherwise we fail to reject H_0.

3.3 Multicollinearity

Multicollinearity, or collinearity, is the existence of near-linear relationships among the independent variables. For example, suppose that the three ingredients of a mixture are studied by including their percentages of the total. These variables will have the (perfect) linear relationship: P1 + P2 + P3 = 100. During regression calculations, this relationship causes a division by zero which in turn causes the calculations to be aborted. When the relationship is not exact, the division by zero does not occur and the calculations are not aborted. However, the division by a very small quantity still distorts the results. Hence, one of the first steps in a regression analysis is to determine if multicollinearity is a problem.

3.3.1 Sources of Multicollinearity

In order to deal with multicollinearity, we must be able to identify its source. The source of the multicollinearity impacts the analysis, the corrections, and the interpretation of the linear model. According to Montgomery [1982], there are five sources to multicollinearity and they are as follows:

i. Data collection. In this case, the data have been collected from a narrow subspace of the independent variables. The multicollinearity has been created by the sampling methodology—it does not exist in the population. Obtaining more data on an expanded range would cure this multicollinearity problem. The extreme example of this is when you try to fit a line to a single point.

ii. Physical constraints of the linear model or population. This source of multicollinearity will exist no matter what sampling technique is used. Many manufacturing or service processes have constraints on independent variables (as to their range), either physically, politically, or legally, which will create multicollinearity.

iii. Over-defined model. Here, there are more variables than observations. This situation should be avoided.

iv. Model choice or specification. This source of multicollinearity comes from using independent variables that are powers or interactions of an original set of variables. It should be noted that if the sampling subspace of independent variables is narrow, then any combination of those variables will increase the multicollinearity problem even further.

v. Outliers. Extreme values or outliers in the X-space can cause multicollinearity as well as hide it. We call this outlier-induced multicollinearity. This should be corrected by removing the outliers before ridge regression is applied.

3.3.2 Effects of Multicollinearity

Multicollinearity can create inaccurate estimates of the regression coefficients, inflate the standard errors of the regression coefficients, deflate the partial t-tests for the regression coefficients, give false, non significant, p-values, and degrade the predictability of the model.

3.3.3 Detection of Multicollinearity

There are several methods of detecting multicollinearity. We mention a few.

i. Begin by studying pair wise scatters plots of pairs of independent variables, looking for near perfect relationships. Also glance at the correlation matrix for high correlations. Unfortunately, multicollinearity does not always show up when considering the variables two at a time ii. Next, consider the variance inflation factors (VIF). VIFs over 10 indicate collinear variables. iii. Eigen values of the correlation matrix of the independent variables near zero indicate

multicollinearity. Instead of looking at the numerical size of the eigenvalue, use the condition number. Large condition numbers indicate multicollinearity iv. Investigate the signs of the regression coefficients. Variables whose regression coefficients are opposite in sign from what you would expect may indicate multicollinearity.

Variance Inflation

The variance inflation factor (VIF) is a measure of multicollinearity. It is the reciprocal of $1-R_x^2$, where R_x^2 is the R^2 obtained when this variable is regressed on the remaining independent variables. A VIF of 10 or more for large data sets indicates a multicollinearity problem since the R_x^2 with the remaining X's is 90 percent.

$$VIF_j = \frac{1}{1-R_j^2} \qquad (3.16)$$

Tolerance

Tolerance is $1-R_x^2$, the denominator of the variance inflation factor.

3.3.4 Correction for Multicollinearity

Depending on what the source of multicollinearity is, the solutions will vary. If the multicollinearity has been created by the data collection, collect additional data over a wider X-subspace. If the choice of the linear model has increased the multicollinearity, simplify the model by using variable selection techniques. If an observation or two has induced the multicollinearity, remove those observations. Above all, use care in selecting the variables at the outset.

When these steps are not possible, we might try ridge regression.

CHAPTER FOUR

ANALYSIS AND DISCUSSION OF RESULTS

4.1 Introduction

This chapter is devoted to data analysis. The method described in chapter three would be employed for the analysis.

The analysis would follow the following order below:

i. to determine the degree of relationship that exists among the selected variables;

ii. to fit a regression model;

iii. to test for the significance of the model;

iv. to determine if there exists multicollinearity problem in the data set; and

v. to test for the normality of the residual

Table 4.1 Descriptive Statistics

Descriptive Statistics

	Mean	Std. Deviation	N
Crude Oil Export	1.4980	.41353	226
Crude Oil Price	78.9185	25.19334	226
Crude Oil Production	1.9480	.41353	226

Findings: The average values of the crude oil export, crude oil price and crude oil production obtained in table 1.4980 are 78.9185, and 1.9480 respectively

Tale 4.2: Correlations

		Crude Oil Price	Crude Oil Production	Crude Oil Export
Crude Oil Price	Pearson Correlation	1	.110	.110
	Sig. (2-tailed)		.099	.099
	N	226	226	226
Crude Oil Production	Pearson Correlation	.110	1	1.000**
	Sig. (2-tailed)	.099		.000
	N	226	226	226
Crude Oil Export	Pearson Correlation	.110	1.000**	1
	Sig. (2-tailed)	.099	.000	
	N	226	226	226

**. Correlation is significant at the 0.01 level (2-tailed).

Findings: The value of correlation obtained among the variables (crude oil production, crude oil price and crude oil export) in table 4.2 shows that there exist strong positive relationships between crude oil production and crude oil export while crude oil price has no relationship with the other two variables.

Table 4.3: Model Summary[b]

Model	R	R Square	Adjusted R Square	Std. Error of the Estimate	Durbin-Watson
1	1.000[a]	1.000	1.000	.00000	.027

a. Predictors: (Constant), Crude Oil Production, Crude Oil Price
b. Dependent Variable: Crude Oil Export

Findings: The value of adjusted R Square obtained in table 4.3 shows that 100% of the crude oil export has been accounted for by the crude oil price and crude oil production and since the value of R Square is 1, it implies that the model obtained is adequate for use.

Coefficients[a]

Model		Unstandardized Coefficients		Standardized Coefficients	t	Sig.	Collinearity Statistics	
		B	Std. Error	Beta			Tolerance	VIF
1	(Constant)	-.450	.000		-75126767.633	.000		
	Crude Oil Price	3.497E-18	.000	.000	.000	1.000	.988	1.012
	Crude Oil Production	1.000	.000	1.000	376472547.821	.000	.988	1.012

a. Dependent Variable: Crude Oil Export

Findings: The result obtained on individual variable test showed that only crude oil production was found to be significant since its p-value of 0.000 is less than significance level of 0.05. The result of VIF obtained also implied that there is no presence of Multicollinearity test in the data set since the value of VIF obtained is less than 10 and the value of Tolerance is far away from 0. Thus, the model obtained is

$$Crude\,Oil\ Export = -0.450 + 3.497E - 18 Crude\,Oil\ \Pr ice + Crude\,Oil\ \Pr oduction$$

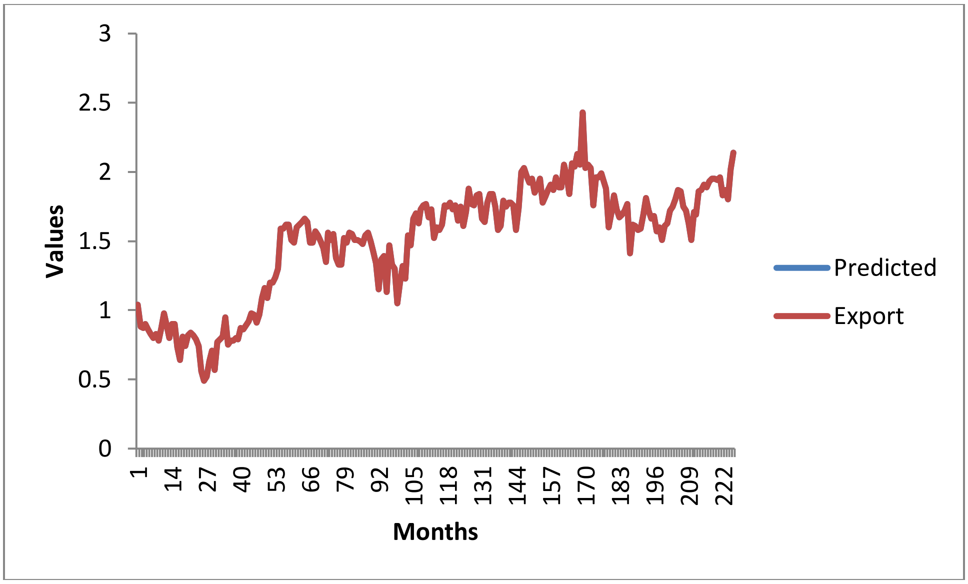

Figure 4.1: The plot of Crude oil export and the predicted values

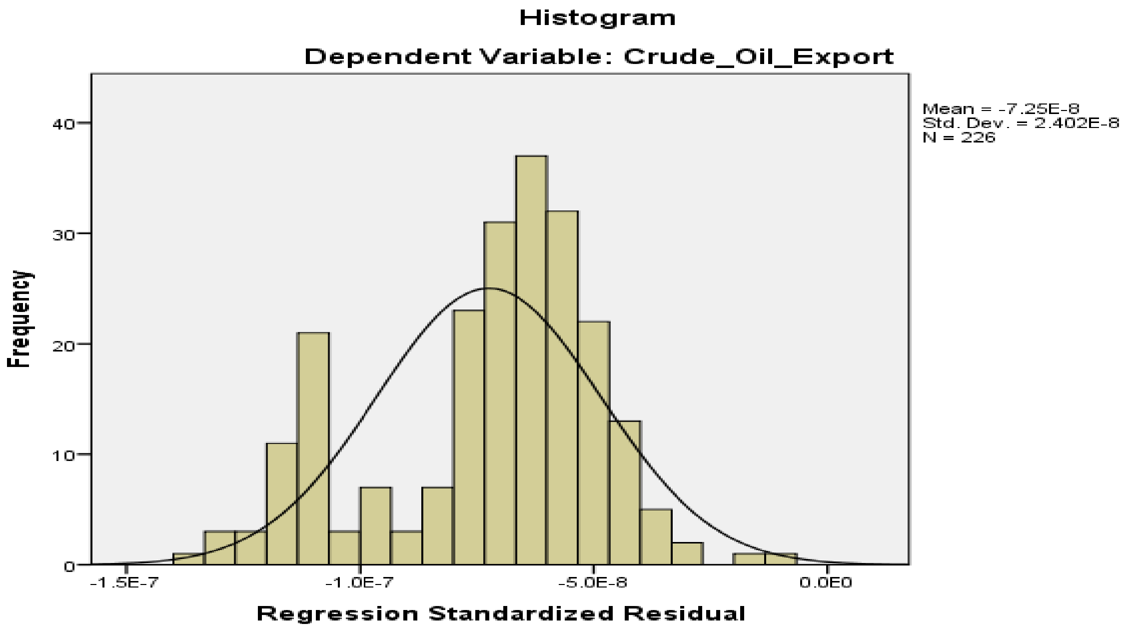

Figure 2: Residual Normality Plot

It was observed from figure 4.2 that the residual normality plot indicates the consistency of the data with a normal distribution. The plot showed a well bell-shaped.

CHAPTER FIVE

SUMMARY OF FINDINGS, CONCLUSION AND RECOMMENDATIONS

5.1 Summary of Findings

The descriptive statistics table shows the average values of crude oil export, crude oil price and crude oil production obtained in table 1.4980 are 78.9185, and 1.9480 respectively. The value of of correlation obtained among the variables (crude oil production, crude oil price and crude oil export) in table 4.2 shows that there exist strong positive relationships between crude oil production and crude oil export while crude oil price has no relationship with the other two variables.

The value of adjusted R Square obtained in table 4.3 shows that 100% of the crude oil export has been accounted for by the crude oil price and crude oil production and since the value of R Square is 1, it implies that the model obtained is adequate for use. The result obtained on individual variable test showed that only crude oil production was found to be significant since its p-value of 0.000 is less than significance level of 0.05. The result of VIF obtained also implied that there is no presence of Multicollinearity test in the data set since the value of VIF obtained is less than 10 and the value of Tolerance is far away from 0.

Thus, the model obtained is

$$Crude\,Oil\;Export = -0.450 + 3.497E - 18Crude\,Oil\;\mathrm{Pr}ice + Crude\,Oil\;\mathrm{Pr}oduction$$

5.2 Conclusion

Based on the analysis carried out on the data, it was discovered that there a perfect relationship among the variables and there exists no problem of Multicollinearity in the data set. The model obtained is adequate for future use and prediction.

5.3 Recommendations

In the light of the findings of the study, it is recommended that:

- Security should be boosted on the high sea where crude oil products are being smuggled. This will help reduce the loss from illegal export of crude oil products.
- Government should give immediate attention to the indigenes of the region where crude oil is being extracted from. This will reduce the unrest in that region.

- Government should establish an institution that will ensure that the multinational oil companies are socially responsible to their host community.
- Government should fight corruption by establishing institution that will arrest and prosecute corrupt public office holders.
- Lastly, a sinking fund should be created from where money would be released to execute the turnaround maintenance of the country refineries in order to ensure a throughout the year supply of oil products and maintain a lead in crude oil production

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APPENDIX

Data Presentation

Year	Month	Crude Oil Price	Crude Oil Production	Crude Oil Export
2024	11	75.44	1.49	1.04
2024	10	76.69	1.33	0.88
2024	9	76.05	1.32	0.87
2024	8	82.88	1.35	0.90
2024	7	87.28	1.31	0.86
2024	6	83.64	1.28	0.83
2024	5	84.01	1.25	0.80
2024	4	93.12	1.28	0.83
2024	3	88.80	1.23	0.78
2024	2	86.08	1.32	0.87
2024	1	82.18	1.43	0.98
2023	12	79.12	1.34	0.89
2023	11	85.76	1.25	0.80

2023	10	94.90	1.35	0.90
2023	9	98.16	1.35	0.90
2023	8	89.30	1.18	0.73
2023	7	82.27	1.09	0.64
2023	6	76.97	1.26	0.81
2023	5	76.91	1.19	0.74
2023	3	81.10	1.27	0.82
2023	2	86.04	1.29	0.84
2023	1	84.78	1.27	0.82
2022	12	82.50	1.24	0.79
2022	11	93.36	1.19	0.74
2022	10	96.57	1.01	0.56
2022	9	93.25	0.94	0.49
2022	8	106.34	0.97	0.52
2022	7	120.54	1.08	0.63
2022	6	130.10	1.16	0.71
2022	5	116.72	1.02	0.57
2022	4	106.51	1.22	0.77
2022	3	121.23	1.24	0.79
2022	2	99.64	1.26	0.81
2022	1	88.71	1.40	0.95
2021	12	65.41	1.20	0.75
2021	11	82.16	1.23	0.78
2021	10	84.11	1.23	0.78
2021	9	74.55	1.25	0.80
2021	8	70.72	1.24	0.79
2021	7	75.93	1.32	0.87
2021	6	73.46	1.31	0.86
2021	5	67.83	1.34	0.89
2021	4	64.30	1.37	0.92
2021	3	65.62	1.43	0.98
2021	2	62.48	1.42	0.97
2021	1	54.87	1.36	0.91
2020	12	50.33	1.42	0.97
2020	11	42.70	1.54	1.09
2020	10	39.74	1.61	1.16
2020	9	40.85	1.54	1.09
2020	8	45.06	1.65	1.20
2020	7	44.10	1.65	1.20
2020	6	40.30	1.69	1.24
2020	5	27.90	1.75	1.30
2020	4	14.28	2.04	1.59
2020	3	32.29	2.04	1.59

2020	2	58.45	2.07	1.62
2020	1	66.68	2.07	1.62
2019	12	68.56	1.96	1.51
2019	11	63.56	1.94	1.49
2019	10	59.10	2.05	1.60
2019	9	65.27	2.07	1.62
2019	8	61.05	2.09	1.64
2019	7	66.24	2.11	1.66
2019	6	66.74	2.09	1.64
2019	5	73.65	1.94	1.49
2019	4	73.08	1.94	1.49
2019	3	67.67	2.02	1.57
2019	2	64.89	1.99	1.54
2019	1	60.39	1.95	1.50
2018	12	62.00	1.90	1.45
2018	11	66.59	1.80	1.35
2018	10	79.18	2.01	1.56
2018	9	79.59	1.96	1.51
2018	8	73.35	2.00	1.55
2018	7	74.72	1.83	1.38
2018	6	75.38	1.78	1.33
2018	5	77.64	1.78	1.33
2018	4	72.37	1.97	1.52
2018	3	74.72	1.94	1.49
2018	2	66.67	2.01	1.56
2018	1	69.68	2.00	1.55
2017	12	65.11	1.96	1.51
2017	11	63.56	1.96	1.51
2017	10	58.46	1.95	1.50
2017	9	56.79	1.93	1.48
2017	8	51.64	1.99	1.54
2017	7	49.01	2.01	1.56
2017	6	47.42	1.95	1.50
2017	5	50.57	1.87	1.42
2017	4	52.94	1.79	1.34
2017	3	52.13	1.60	1.15
2017	2	46.39	1.82	1.37
2017	1	55.01	1.84	1.39
2016	12	53.48	1.58	1.13
2016	11	45.25	1.92	1.47
2016	10	50.94	1.78	1.33
2016	9	47.43	1.75	1.30
2016	8	46.15	1.50	1.05

2016	7	45.25	1.65	1.20
2016	6	48.46	1.77	1.32
2016	5	47.01	1.68	1.23
2016	4	41.59	1.99	1.54
2016	3	37.76	1.92	1.47
2016	2	31.70	2.11	1.66
2016	1	30.66	2.15	1.70
2015	12	37.80	2.08	1.63
2015	11	44.82	2.18	1.73
2015	10	48.86	2.21	1.76
2015	9	48.08	2.22	1.77
2015	8	47.09	2.12	1.67
2015	7	57.01	2.18	1.73
2015	6	62.06	1.97	1.52
2015	5	65.08	2.05	1.60
2015	4	57.45	2.03	1.58
2015	3	56.69	2.07	1.62
2015	2	58.09	2.21	1.76
2015	1	48.81	2.20	1.75
2014	12	63.28	2.23	1.78
2014	11	80.42	2.18	1.73
2014	10	83.50	2.21	1.76
2014	9	98.27	2.10	1.65
2014	8	102.33	2.20	1.75
2014	7	109.63	2.06	1.61
2014	6	114.60	2.16	1.71
2014	5	111.90	2.33	1.88
2014	4	110.41	2.22	1.77
2014	3	109.47	2.21	1.76
2014	2	110.83	2.28	1.83
2014	1	110.19	2.29	1.84
2013	12	112.75	2.11	1.66
2013	11	111.14	2.09	1.64
2013	10	112.29	2.23	1.78
2013	9	113.59	2.29	1.84
2013	8	107.84	2.29	1.84
2013	7	109.78	2.20	1.75
2013	6	106.06	2.03	1.58
2013	5	106.00	2.06	1.61
2013	4	105.55	2.24	1.79
2013	3	112.79	2.20	1.75
2013	2	118.81	2.23	1.78
2013	1	115.24	2.23	1.78

2012	12	114.49	2.21	1.76
2012	11	111.05	2.03	1.58
2012	10	108.92	2.19	1.74
2012	9	114.36	2.45	2.00
2012	8	113.76	2.48	2.03
2012	7	104.62	2.42	1.97
2012	6	98.06	2.37	1.92
2012	5	113.08	2.40	1.95
2012	4	122.62	2.30	1.85
2012	3	128.00	2.34	1.89
2012	2	121.87	2.40	1.95
2012	1	113.81	2.23	1.78
2011	12	111.46	2.27	1.82
2011	11	113.92	2.32	1.87
2011	10	113.12	2.36	1.91
2011	9	115.73	2.32	1.87
2011	8	111.99	2.41	1.96
2011	7	117.86	2.34	1.89
2011	6	117.03	2.34	1.89
2011	5	118.43	2.50	2.05
2011	4	124.49	2.42	1.97
2011	3	116.56	2.29	1.84
2011	2	106.57	2.51	2.06
2011	1	97.96	2.49	2.04
2010	12	92.79	2.58	2.13
2010	11	86.71	2.50	2.05
2010	10	84.42	2.88	2.43
2010	9	79.45	2.48	2.03
2010	8	78.67	2.50	2.05
2010	7	77.18	2.48	2.03
2010	6	75.79	2.21	1.76
2010	5	77.54	2.41	1.96
2010	4	85.29	2.41	1.96
2010	3	80.27	2.44	1.99
2010	2	75.06	2.39	1.94
2010	1	77.62	2.33	1.88
2009	12	75.11	2.05	1.60
2009	11	78.11	2.15	1.70
2009	10	78.25	2.28	1.83
2009	9	70.22	2.18	1.73
2009	8	74.00	2.12	1.67
2009	7	66.52	2.14	1.69
2009	6	72.24	2.17	1.72

2009	5	60.02	2.22	1.77
2009	4	51.16	1.86	1.41
2009	3	49.70	2.07	1.62
2009	2	46.52	2.06	1.61
2009	1	44.95	2.03	1.58
2008	12	45.87	2.04	1.59
2008	11	55.51	2.14	1.69
2008	10	75.31	2.26	1.81
2008	9	103.82	2.17	1.72
2008	8	115.84	2.11	1.66
2008	7	137.74	2.13	1.68
2008	6	138.74	2.02	1.57
2008	5	126.57	2.05	1.60
2008	4	116.73	1.96	1.51
2008	3	103.73	2.06	1.61
2008	2	98.15	2.08	1.63
2008	1	94.26	2.17	1.72
2007	12	93.40	2.20	1.75
2007	11	95.05	2.25	1.80
2007	10	83.86	2.32	1.87
2007	9	79.76	2.31	1.86
2007	8	73.76	2.20	1.75
2007	7	79.76	2.17	1.72
2007	6	73.28	2.08	1.63
2007	5	70.40	1.96	1.51
2007	4	70.46	2.16	1.71
2007	3	64.28	2.14	1.69
2007	2	59.97	2.31	1.86
2007	1	55.57	2.32	1.87
2006	12	64.70	2.36	1.91
2006	11	59.81	2.34	1.89
2006	10	59.49	2.38	1.93
2006	9	62.97	2.40	1.95
2006	8	75.15	2.40	1.95
2006	7	75.13	2.39	1.94
2006	6	69.32	2.41	1.96
2006	5	71.18	2.28	1.83
2006	4	72.09	2.32	1.87
2006	3	65.00	2.25	1.80
2006	2	61.33	2.47	2.02
2006	1	63.85	2.59	2.14