International Journal of Research
Available at https://journals.pen2print.org/index.php/ijr/
e-ISSN: 2348-6848
p-ISSN: 2348-795X
Volume 06 Issue 04
April 2019

Statistical Analysis of Crude Oil Price per Barrel in Nigeria

Bature, Tajudeen Atanda[1], Rahaman, Aliyu[2], Sulaiman, Yunus Aduagba[3]

[1] Kwara State Polytechnic, Department of Mathematics, Ilorin,

[2] The Oke-Ogun Polytechnic, Department of Mathematics and Statistics, Saki

[3] Kwara State Polytechnic, Ilorin,

Email: tajudeenatanda1@gmail.com

ABSTRACT

This research work was designed to investigate monthly price of crude oil in US dollar per barrel over ten years beginning from 2006-2016. This was achieved by finding the trend i.e. the general direction which the data follows and also forecasting future values. Time series analysis was carried out on the data extracted from the annual Bulletin of Nigerian Petroleum Corporation (NNPC). The behavior of the price of crude oil was examined using suitable time series model over the study period. Also, various methods was used to compute and analyze the given data. These methods are; Least squares method, estimation of seasonal variation and estimation of the deseasonalized.

Keywords: Estimation of Seasonal Variation, Estimation of the deseasonalized, Forecasting and Trend

1.0 INTRODUCTION

The price of oil generally refers to the spot price of a barrel of bench mark oil- a reference price for buyers and sellers of crude oil such as west Texas intermediate (WTI), Brent ICE, Dubai crude, OPEC Reference Basket, Tapic Crude, Bonny light, Urals oil, Isthmus and western Canadian select (WCS). There is a differential in the price of a barrel of oil based on its grade- determined by factors such as its specific gravity or API and its sulphur content- and its location- for example its proximity to tide water and/or refineries. Heavier, sour crude oils lacking in tide water access- such as western Canadian select- are less expensive and lighter, sweeter oil such as WTI.

Oil prices are determined by commodities traders who bid on oil future contracts in the commodity market. These contracts are agreement to buy or sell oil at a specific date in the future for an agreed – upon price. They are executed on the floor of a commodity exchange by traders who are registered with the commodities future trading commission. Commodities have been traded for more than 100 years, and have been regulated by the commodities future traders commission (CFTC) since the 1920s. The main factors that commodities traders look at when developing the bids that create oil process are current supply in terms of output, access to future supply and demand for oil.

In 1960, the organization of petroleum exporting countries (OPEC) was founded in Baghdad, Iraq by its first five members- Islamic republic of Iran, Iraq, Kuwait, Saudi Arabia and Venezuela- to try to counter the oil companies' cartel which had been controlling posted prices. OPEC's stated mission is "to co-ordinate and unify the petroleum policies of its member countries and ensure the stabilization of oil markets in order to secure an efficient, economic and regular supply of petroleum to consumers, a steady income to producers, and a fair return on capital for those investing in the petroleum industry". As of January 2017, OPEC's members are Algeria, Angola, Ecuador, Gabon, Iran, Iraq, Kuwait, Libya, Nigeria, Qatar, Saudi Arabia, United Arab Emirates and Venezuela.

Nigeria became a member of OPEC in 1971 after its establishment in September 1960. Its oil policies were sine in line with other member countries. For instance, she had reserved for herself the right to acquire participating interest in Agip oil as early as 1966, exercise such an option by acquiring 33.3% in EIF oil in 1971. By April 1971, Nigeria had established the Nigerian National oil company to give effect to the government's desire to participate effectively in strategic industries as expounded inthe first National development plan (1962 – 1968). This with production level of about 1,5 million barrel per day in 1971, representing about 3% of the total world oil production and 6 – 7% of the OPEC production. Nigeria had established herself as a substantial net explorer of crude oil. In view of these fiscal policies already taken to be in line with other member countries of OPEC, Nigeria had already fulfilled all the basic requirements of OPEC. It has also in the mutual interest of the other oil exploring countries that Nigeria should become a member. In order to add force to the control from the major foreign oil companies briefly, the functions of OPEC is to stabilize and control the world oil output and price of crude in the world market.

. 2.0 LITERATURE REVIEW

The word "Petroleum" means "rock oil" or "oil from the earth" (EIA 2005). Mankind has known petroleum or crude oil since the dawn of civilization. It was used in ancient Persia and Burma, particularly as fuel for lamps. Burning of the natural gas (escaping from petroleum underground) gave the 'perpetual fire' at Baba Gurgur in Iraq (Arene and Kitwood 1979).

Petroleum has two main uses. The first is as a fuel. The combustion of crude oil gave in-road to deviation of various energies from petroleum. Petroleum has been a source of energy for heating, lighting and locomotion and particularly the most convenient fuel for internal combustion engine. The use has increased rapidly in importance with the coming of the motor car and wide range of other applications of internal combustion engine (Bankole and Ogunkoya, 1978).

The second use of petroleum is the synthesis of organic compounds. By 1965, about 80% of the world organic chemicals were synthesized from petroleum. This figure rose to 98% in 1980 and 99% in the year 2000. Thus, petroleum chemicals (Petrochemicals) are a wide variety of chemicals. Commercially important ones include gasoline and kerosene. Petroleum jelly is a greasy gelatinous substance sourced from petroleum and used as

ointment base, lubricant and protective covering (Arene and Kitwood, 1979).

Nelson (1954) wrote on two plausible schools of thought on the origin and formation of petroleum. The older one, "the organic matter theory", suggests that petrolrum was formed from the decomposition of dead marine organisms, like plankton. Compounds (eg; fats) which are very similar to hydrocarbons and even have traces of certain hydrocarbons themselves, are present in virtually all forms of plant and animal life. The theory is supported by the finding that very recent marine deposits (10,000 to 15,000 years old) contain hydrocarbon and asphaltic material. Besides, there is a similarity between the molecular structures of some of the minor constituents of crude oil and those of compounds found in living organisms. Again, it is hard to see where else the carbon content of petroleum could have come from other than biological material, if indeed its origin is geologically fairly recent.

Also, supporting this view, Arene and Kitwood (1979) submit that petroleum is crude oil that occurs naturally in sedimentary rocks. It had collected into small small pools from seepage from underground. Aligning with this claim, EIA (2005) states that petroleum was formed from the remains of animals and plants that lived millions of years ago in a marine (water) environment before the dinosaurs. About 300 – 400 million years ago, tiny sea plants and animals died and were buried on the ocean floor. Over time, layers of silt and sand covered them. About 50 - 100 million years ago, the remains were buried deeper and deeper and covered by layers of mud. The enormous heat and pressure from these layers turned the remains into crude oil and gas. Today, drilling down through the layers of silt, sand and rock help to reach the rock formations that contain crude oil and gas deposits.

3.0 RESEARCH METHODOLOGY

This is the general research strategy that outlines the way in which research is to be undertaken and among other things identifies the method to be used in it. It also define the means or modes of data collection and how a specific result is to be calculated.

3.1.1 TIME SERIES

This is a collection of observations made sequentially at regular interval of time. time series can also be defined as a group or sequence of values of a variable recorded in chronological order as the observations are made at specified and often regular time interval

.

3.1.2 MOVING AVERAGE METHOD

The method of moving average is to replace a particular measurement by the arithmetic mean of a series of measurement of which it is the centre. When an odd number is chosen, the moving average is centered as an observed measurement. But in a case where an even number of measurement is chosen, the ing average is centered between two rved measurements and must be re-centered before comparison can be made between the averages and the measurements.

Suppose we are given $X_1, X_2, \ldots, X_N$ on a trend X_t, the n-point moving average are:

International Journal of Research
Available at https://journals.pen2print.org/index.php/ijr/
e-ISSN: 2348-6848
p-ISSN: 2348-795X
Volume 06 Issue 04
April 2019

$$Y_1 = \frac{X_1+X_2+\ldots+X_N}{n}$$
$$Y_2 = \frac{X_2+X_3+\ldots+X_N}{n}$$
$$\vdots$$
$$Y_{N-n} = \frac{X_{N-n}+X_{N-n}+\ldots+X_N}{n}$$

3.1.3 ESTIMATION OF SEASONAL VARIATION

In the time series analysis, estimation of seasonal variation is very important as it helps in the planning of production programmed. To estimate seasonal variation, we employ either the additive model or the multiplicative model.

3.1.4 ADDITIVE MODEL Suppose a series(X_t) has an additive relationship with the time series components i.e. $X_t = T_t + S_t + C_t + I_t$,
Then the seasonal variation at time t (S_t) will be given as;

$$S_t = X_t - T_t.$$

The summation of seasonal index for additive model is expected to be zero or 0%. If the sum of the SI is less than or greater than the required total (zero or 0%), then the adjustment is needed **i.e. Adjustment** = $\propto_i - \frac{\propto}{4}$

Where: $\propto_i$ = Average of each quarter
$\propto$ = grand total of average (i.e$SI_1 + SI_2 + SI_2 + SI_4$)

3.1.5 MULTIPLICATIVE MODEL

Suppose we assume a multiplicative model of the form $X_t = T_t \times S_t \times C_t \times I_t$. So, having estimated the trend, the seasonal variation at time t (S_t) will be given as;

$S_t = \frac{X_t}{T_t}$.

The summation of seasonal index for multiplicative model is expected to be four or 400%. If the sum of the SI is less than or greater than the required total (four or 400%), then the adjustment is needed **i.e. Adjustment** = $\propto_i \times \frac{4}{\propto}$.

Where: $\propto_i$ = Average of each quarter
$\propto$ = Sum of means of each quarter.

3.1.6 DESEASONALIZATION OF DATA

This is the removal of seasonal variation from the data. A deseasonalized data is the data which trend removes the effects of seasonal fluctuation from the given data i.e. it shows what the trend would look like if it does not contain seasonal variation. Before we can deseasonalize, we need to assume either the additive or multiplicative model. In other words, if the original data are divided by corresponding seasonal index numberSI_t, the resulting data are said to be deseasonalized or adjusted for seasonal variation i.e.

$$X'_t = \frac{X_t}{SI_t}, \forall t.$$

Where: X'_t is a deseasonalized?

3.1.7 FORECASTING

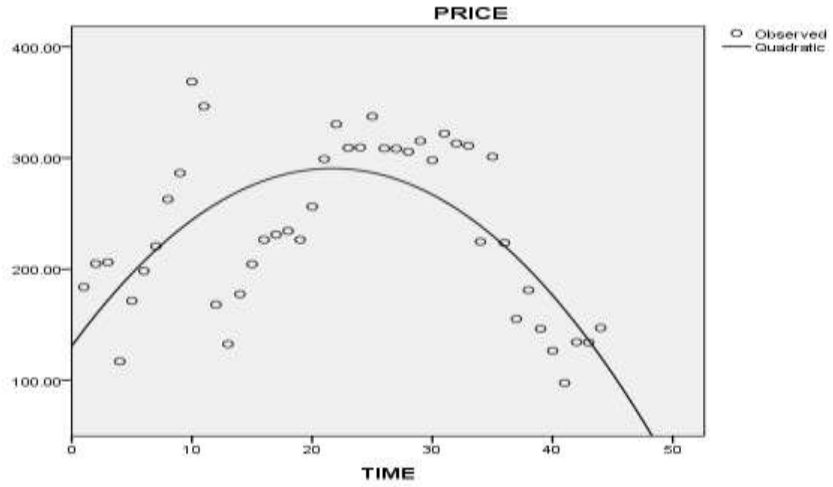
Forecasting is very important in time series analysis. It can be used as a tool for decision making if it is used intelligently with full recognition of its limitations. Although, one cannot be exact in the estimation of any figure movement in income, expenditure or sales, but one can at least estimate it to the nearest accurate level. These estimates and forecasts are necessary as they aid an organization or industry in planning and in preparation for the future.

Forecasts can be made using either the additive model or the multiplicative model. For each of the two methods, the procedures are as follows;

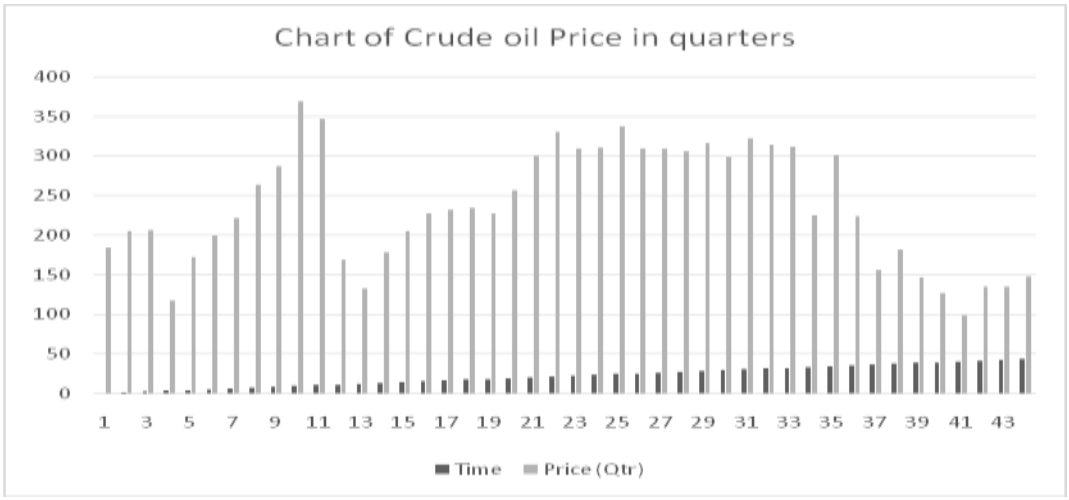
4.0 DATA ANALYSIS

International Journal of Research
Available at https://journals.pen2print.org/index.php/ijr/
e-ISSN: 2348-6848
p-ISSN: 2348-795X
Volume 06 Issue 04
April 2019

4.1 TIME PLOT: QUARTERLY PRICE AGAINST TIME



4.1.2 MULTIPLE BAR CHART: QUARTERLY PRICE OF CRUDE OIL



4.1.3 ESTIMATION OFTREND USING LEAST SQUARES METHOD

To estimate the trend using the least squares method, we fit a trend thus;

International Journal of Research
Available at https://journals.pen2print.org/index.php/ijr/
e-ISSN: 2348-6848
p-ISSN: 2348-795X
Volume 06 Issue 04
April 2019

$$T_t = \hat{a} + \hat{b}t$$ -Equation (4.1)

Where: $\hat{b} = \frac{n\sum tX_t - \sum t \sum X_t}{n\sum t^2 - (\sum t)^2}$ -Equation (4.2)

$$\hat{a} = \bar{X} - \hat{b}\bar{t}$$ -Equation (4.3)

Where:

$$\bar{X} = \frac{\sum X}{n} \; and \; \bar{t} = \frac{\sum t}{n}$$

From the table above;

n= 44, $\sum t X_t = 229{,}264.87$, $\sum t = 990$, $\sum t^2 = 29370$, $\sum X_t = 10365.02$

substitute the values above into equation (4.2) and equation (4.3)

$$\hat{b} = \frac{44(229264.87) - 990(10365.02)}{44(29370) - (990^2)}$$

$$\hat{b} = \frac{10087654.28 - 10261369.8}{1292280 - 980100}$$

$$\hat{b} = \frac{-173715.52}{312180}$$

$$\hat{b} = -0.5565$$

Hence,

$$\hat{a} = \frac{10365.02}{44} - (-0.5565)(\frac{990}{44})$$

$$\hat{a} = 235.5686 - (-0.5565)(22.5)$$

$$\hat{a} = 235.5686 + 12.5213$$

$$\hat{a} = 248.0899$$

International Journal of Research
Available at https://journals.pen2print.org/index.php/ijr/
e-ISSN: 2348-6848
p-ISSN: 2348-795X
Volume 06 Issue 04
April 2019

Therefore, the trend line is;

$$T_t = 248.0899 - 0.5565t$$

4.1.4 ESTIMATION OF SEASONAL VARIATION BY LEAST SQUARES METHOD USING ADDITIVE MODEL

TABLE 4.1: Computation of $X_t - T_t$ values

YEAR	QTR	X_t	T_t	$X_t - T_t$	SI_t
2006	1	183.90	247.5324	-63.6334	-7.3130
	2	204.90	246.9769	-42.0769	5.8493
	3	206.29	246.4204	-40.1304	12.2722
	4	117.08	245.8639	-128.7839	-10.8085
2007	1	171.58	245.3074	-73.7274	-7.3130
	2	198.39	244.7509	-46.3609	5.8493
	3	220.71	244.1944	-23.4844	12.2722
	4	262.85	243.6379	19.2121	-10.8085
2008	1	286.41	243.0814	43.3286	-7.3130
	2	368.64	242.5249	126.1151	5.8493
	3	346.41	241.9684	104.4416	12.2722
	4	168.26	241.4119	-73.1519	-10.8085

2009	1	132.62	240.8554	-107.6789	-7.3130
	2	177.51	240.2989	-62.7889	5.8493
	3	204.46	239.7424	-35.2324	12.2722
	4	226.52	239.1859	-12.6659	-10.8085
2010	1	231.14	238.6294	-7.4894	-7.3130
	2	234.41	238.0729	-3.6629	5.8493
	3	226.51	237.5164	-11.0064	12.2722
	4	256.32	236.9599	19.3601	-10.8085
2011	1	299.04	236.4034	62.6366	-7.3130
	2	330.35	235.8469	94.5031	5.8493
	3	309.16	235.2904	73.8696	12.2722
	4	309.54	234.7339	74.8061	-10.8085
2012	1	337.38	234.1774	103.2026	-7.3130
	2	308.64	233.6209	75.0191	5.8493
	3	308.35	233.0644	75.2856	12.2722
	4	305.73	232.5079	73.2221	-10.8085
2013	1	315.31	231.9514	83.3586	-7.3130
	2	297.94	231.3949	66.5451	5.8493
	3	322.05	230.8384	91.2116	12.2722

International Journal of Research
Available at https://journals.pen2print.org/index.php/ijr/
e-ISSN: 2348-6848
p-ISSN: 2348-795X
Volume 06 Issue 04
April 2019

	4	313.05	230.2819	82.7681	-10.8085
2014	1	311.11	229.7254	81.3846	-7.3130
	2	224.71	229.1689	-4.4589	5.8493
	3	301.16	228.6124	72.5476	12.2722
	4	223.64	228.0559	-4.4159	-10.8085
2015	1	155.21	227.4994	-72.2894	-7.3130
	2	181.22	226.9429	-45.7229	5.8493
	3	146.44	226.3864	-79.9464	12.2722
	4	126.65	225.8299	-99.1799	-10.8085
2016	1	97.71	225.2734	-127.5634	-7.3130
	2	134.42	224.7169	-90.2969	5.8493
	3	134.12	224.1604	-90.0404	12.2722
	4	147.18	223.6033	-76.4233	-10.8085

4.1.5 ESTIMATION OF SEASONAL VARIATION BY MOVING AVERAGE METHOD USING MULTIPLICATIVE MODEL

TABLE 4.2: Computation of $\frac{X_t}{T_t}$ values

International Journal of Research
Available at https://journals.pen2print.org/index.php/ijr/
e-ISSN: 2348-6848
p-ISSN: 2348-795X
Volume 06 Issue 04
April 2019

YEAR	QTR	X_t	T_t	$\frac{X_t}{T_t}$	SI_t
2006	1	183.90	-	-	0.9515
	2	204.90	-	-	1.0324
	3	206.29	176.5025	1.1688	1.0696
	4	117.08	174.1488	0.6723	0.9465
2007	1	171.58	175.1375	0.9797	0.9515
	2	198.39	195.1613	1.0165	1.0324
	3	220.71	226.6113	0.9740	1.0696
	4	262.85	263.3713	0.9980	0.9465
2008	1	286.41	300.3650	0.9535	0.9515
	2	368.64	304.2538	1.2116	1.0324
	3	346.41	273.2063	1.2679	1.0696
	4	168.26	230.0913	0.7313	0.9465
2009	1	132.62	18834563	0.7037	0.9515
	2	177.51	177.9950	0.9973	1.0324
	3	204.46	197.5925	1.0353	1.0696
	4	226.52	217.0200	1.0437	0.9465
2010	1	231.14	226.8888	1.0187	0.9515
	2	234.41	233.3700	1.0045	1.0324

	3	226.51	245.5825	0.9215	1.0696
	4	256.32	266.0625	0.9634	0.9465
2011	1	299.04	288.3863	1.0369	0.9515
	2	330.35	305.3700	1.0818	1.0324
	3	309.16	316.8150	0.9758	1.0696
	4	309.54	318.8938	0.9707	0.9465
2012	1	337.38	316.0788	1.0674	0.9515
	2	308.64	315.5013	0.9783	1.0324
	3	308.35	312.2663	0.9875	1.0696
	4	305.73	308.1700	0.9921	0.9465
2013	1	315.31	308.5450	1.0219	0.9515
	2	297.94	311.1725	0.9575	1.0324
	3	322.05	311.5625	1.0337	1.0696
	4	313.05	301.5625	1.0370	0.9465
2014	1	311.11	290.1188	1.0724	0.9515
	2	224.71	276.3313	0.8132	1.0324
	3	301.16	245.6675	1.2259	1.0696
	4	223.64	220.7438	1.0131	0.9465
2015	1	155.21	195.9675	0.7920	0.9515

International Journal of Research
Available at https://journals.pen2print.org/index.php/ijr/
e-ISSN: 2348-6848
p-ISSN: 2348-795X
Volume 06 Issue 04
April 2019

	2	181.22	164.5038	1.1016	1.0324
	3	146.44	145.1925	1.0086	1.0696
	4	126.65	132.1550	0.9583	0.9465
2016	1	97.71	124.7650	0.7832	0.9515
	2	134.42	125.7913	1.0686	1.0324
	3	134.12	-	-	1.0696
	4	147.18	-	-	0.9465

4.1.6 ADJUSTED SEASONAL VARIATION FOR MULTIPLICATIVE MODEL

The $\frac{X_t}{T_t}$ values are arranged according to their respective quarters as follows;

TABLE 4.3: Estimation of seasonal indices for multiplicative model

YEAR/QTR	Q_1	Q_2	Q_3	Q_4
2006	-	-	1.1688	0.6723
2007	0.9797	1.0165	0.9740	0.9980
2008	0.9535	1.2116	1.2679	0.7313
2009	0.7037	0.9973	1.0353	1.0437
2010	1.0187	1.0045	0.9215	0.9634
2011	1.0369	1.0818	0.9758	0.9707
2012	1.0674	0.9783	0.9875	0.9921

International Journal of Research
Available at https://journals.pen2print.org/index.php/ijr/
e-ISSN: 2348-6848
p-ISSN: 2348-795X
Volume 06 Issue 04
April 2019

2013	1.0219	0.9575	1.0337	1.0370
2014	1.0724	0.8132	1.2259	1.0131
2015	0.7920	1.1016	1.0086	0.9583
2016	0.7832	1.0686	-	-
TOTAL	9.4294	10.2309	10.5990	9.3799
MEAN	0.9429	1.0231	1.0599	0.9380
ADJUSTED SI	0.9515	1.0324	1.0696	0.9465

Since the sum of averages is3.9639 which is not equal to four, then we need to adjust the averages i.e. Adjustment = $\propto_i X \frac{4}{\propto}$

For Q_1 = 0.9429 X $\frac{4}{3.639} = 0.9515$

For Q_2 = 1.0231 X $\frac{4}{3.639} = 1.0324$

For Q_3 = 1.0599 X $\frac{4}{3.9639} = 1.0696$

For Q_4 = 0.9380 X $\frac{4}{3.9639} = 0.9465.$

$\therefore$Total $= 4.0$

4.1.7 THE DESEASONALIZATION OF DATA USING ADDITIVE MODEL

TABLE 4.4: Computation of the deseasonalized data for additive model

International Journal of Research
Available at https://journals.pen2print.org/index.php/ijr/
e-ISSN: 2348-6848
p-ISSN: 2348-795X
Volume 06 Issue 04
April 2019

YEAR	QTR	X_t	SI_t	$X_t' = X_t - SI_t$
2006	1	183.90	-6.56	190.46
	2	204.90	3.95	200.95
	3	206.29	13.27	193.02
	4	117.08	-10.66	187.74
2007	1	171.58	-6.56	178.14
	2	198.39	3.95	194.44
	3	220.71	13.27	207.44
	4	262.85	-10.66	273.51
2008	1	286.41	-6.56	292.97
	2	368.64	3.95	364.69
	3	346.41	13.27	233.14
	4	168.26	-10.66	178.92
2009	1	132.62	-6.56	139.18
	2	177.51	3.95	173.56
	3	204.46	13.27	191.29
	4	226.52	-10.66	237.20
2010	1	231.14	-6.56	237.70
	2	234.41	3.95	230.46

	3	226.51	13.27	213.24
	4	256.32	-10.66	266.98
2011	1	299.04	-6.56	305.60
	2	330.35	3.95	326.40
	3	309.16	13.27	295.89
	4	309.54	-10.66	320.20
2012	1	337.38	-6.56	343.94
	2	308.64	3.95	304.69
	3	308.35	13.27	295.08
	4	305.73	-10.66	316.39
2013	1	315.31	-6.56	321.87
	2	297.94	3.95	293.99
	3	322.05	13.27	308.78
	4	313.05	-10.66	323.71
2014	1	311.11	-6.56	317.67
	2	224.71	3.95	220.76
	3	301.16	13.27	287.89
	4	223.64	-10.66	234.30
2015	1	155.21	-6.56	161.77

International Journal of Research
Available at https://journals.pen2print.org/index.php/ijr/
e-ISSN: 2348-6848
p-ISSN: 2348-795X
Volume 06 Issue 04
April 2019

	2	181.22	3.95	177.27
	3	146.44	13.27	133.17
	4	126.65	-10.66	137.31
2016	1	97.71	-6.56	104.27
	2	134.42	3.95	130.47
	3	134.12	13.27	120.85
	4	147.18	-10.66	157.84

4.1.8 THE DESEASONALIZATION OF DATA USING THE MULTIPLICATIVE MODEL

TABLE 4.5: Computation of the deseasonalized data for the multiplicative model

YEAR	QTR	X_t	SI_t	$X'_t = \frac{X_t}{SI_t}$
2006	1	183.90	0.9515	193.58
	2	204.90	1.0324	198.93
	3	206.29	1.0696	192.79
	4	117.08	0.9465	123.24
2007	1	171.58	0.9515	180.61
	2	198.39	1.0324	192.61

	3	220.71	1.0696	206.27
	4	262.85	0.9465	276.68
2008	1	286.41	0.9515	301.48
	2	368.64	1.0324	357.90
	3	346.41	1.0696	323.75
	4	168.26	0.9465	177.12
2009	1	132.62	0.9515	139.60
	2	177.51	1.0324	172.34
	3	204.46	1.0696	191.18
	4	226.52	0.9465	238.43
2010	1	231.14	0.9515	243.31
	2	234.41	1.0324	227.58
	3	226.51	1.0696	211.69
	4	256.32	0.9465	269.81
2011	1	299.04	0.9515	314.78
	2	330.35	1.0324	320.73
	3	309.16	1.0696	288.93
	4	309.54	0.9465	325.83
2012	1	337.38	0.9515	355.14

	2	308.64	1.0324	299.65
	3	308.35	1.0696	288.18
	4	305.73	0.9465	321.82
2013	1	315.31	0.9515	331.80
	2	297.94	1.0324	289.26
	3	322.05	1.0696	300.98
	4	313.05	0.9465	329.53
2014	1	311.11	0.9515	327.48
	2	224.71	1.0324	218.17
	3	301.16	1.0696	281.46
	4	223.64	0.9465	235.41
2015	1	155.21	0.9515	163.38
	2	181.22	1.0324	175.94
	3	146.44	1.0696	136.86
	4	126.65	0.9465	133.32
2016	1	97.71	0.9515	102.85
	2	134.42	1.0324	130.50
	3	134.12	1.0696	125.35
	4	147.18	0.9465	154.93

International Journal of Research
Available at https://journals.pen2print.org/index.php/ijr/
e-ISSN: 2348-6848
p-ISSN: 2348-795X
Volume 06 Issue 04
April 2019

4.1.9 FORECASTING USING LEAST SQUARES AND ADDITIVE MODEL

TABLE 4.6: Computation of forecasted values for additive model

YEAR	QTR	t	$T_t = 248.0899 - 0.5565t$	SI_t	$X_t = T_t + SI_t$
2017	1	45	223.0474	-7.3130	215.7344
	2	46	222.4909	5.8493	228.3402
	3	47	221.9344	12.2722	234.2066
	4	48	221.3779	-10.8085	210.5694
2018	1	49	220.8214	-7.3130	213.5084
	2	50	220.2649	5.8493	226.1142
	3	51	219.7084	12.2722	231.9806
	4	52	219.1519	-10.8085	208.3434
2019	1	53	218.5954	-7.3130	211.2824
	2	54	218.0389	5.8493	223.8882
	3	55	217.4824	12.2722	229.7546
	4	56	216.9269	-10.8085	206.1184
2020	1	57	216.3694	-7.3130	209.0564
	2	58	215.8129	5.8493	221.6622
	3	59	215.2564	12.2722	228.0851
	4	60	214.6999	-10.8085	203.8914

International Journal of Research
Available at https://journals.pen2print.org/index.php/ijr/
e-ISSN: 2348-6848
p-ISSN: 2348-795X
Volume 06 Issue 04
April 2019

2021	1	61	214.1434	-7.3130	206.8304
	2	62	213.5869	5.8493	219.4362
	3	63	213.0304	12.2722	225.3026
	4	64	212.4739	-10.8085	201.6654

4.1a FORECASTING USING LEAST SQUARES AND MULTIPLICATIVE MODEL

Also, we use multiplicative model to forecast.

TABLE 4.7: Computation of forecasted values for the multiplicative model

YEAR	QTR	t	$T_t = 248.0899 - 0.5565t$	SI_t	$X_t = T_t \, X \, SI_t$
2017	1	45	223.0474	0.9707	216.5121
	2	46	222.4909	1.0248	228.0087
	3	47	221.9344	1.0523	233.5416
	4	48	221.3779	0.9523	210.8182
2018	1	49	220.8214	0.9707	215.3320
	2	50	220.2649	1.0248	225.7275
	3	51	219.7084	1.0523	231.1991
	4	52	219.1519	0.9523	208.6984
2019	1	53	218.5954	0.9707	212.1906

	2	54	218.0389	1.0248	223.4463
	3	55	217.4824	1.0523	228.8567
	4	56	216.9269	0.9523	206.5795
2020	1	57	216.3694	0.9707	210.0298
	2	58	215.8129	1.0248	221.1651
	3	59	215.2564	1.0523	226.5143
	4	60	214.6999	0.9523	261.5967
2021	1	61	214.1434	0.9707	207.8690
	2	62	213.5869	1.0248	218.8839
	3	63	213.0304	1.0523	224.1719
	4	64	212.4739	0.9523	202.3389

5.0 FINDING AND CONCLUSION

The determination of the trend at which things are expected to happen is called **forecasting**. Forecasting is used in time series analysis to estimate what future values will look like. This is achieved by using the values of the trend (T_t) obtained by least squares method and the seasonal index. The trend value is obtained for any future period and is then adjusted for the seasonal variation.

5.1 CONCLUSION

The monthly record of the price of crude oil (petroleum) in US dollar per barrel (2006 - 2016) was analyzed in this research work using the time series analysis. The seasonal variation and the trend were used in estimating future .

After analyzing the data, the trend line revealed that $\boldsymbol{T_t = 248.0899 - 0.5565t}$. This implies that the price of crude oil reduces at the rate of **0.5565**. It can also be observed that the future price of crude oil fluctuates i.e. it is unstable and it will fall slightly further for the next five years. It can be noticed from the original data that

the price of crude oil started its decline from the 4th quarter of 2014 where it continued dropping to as low as $97.71 per barrel in the 1st quarter of 2016. According to experts in the oil industry, the major factors that are responsible for the sudden and continuous drop in the price of crude oil are; low demand due to weak economic activities, a growing switch away from oil to other fuels, the turmoil in Iraq and Libya (two big oil producers with nearly 4m barrels a day combined) has not affected their output and America's low demand for oil (America use to be the world's largest importers of crude oil).

It is important to note that the oil industry is largely controlled by the demand for and supply of oil. If the supply for oil is low and the demand is high, the price of crude oil is bound to go up. But in a situation where the supply is high and the demand for oil is low, the price reduces, this is the case currently faced by the oil industry today.

REFERENCES

[1]. Arene, E. O. and T. Kitwood (1979). An Introduction to the chemistry of carbon compounds. Longman Group Ltd; London.

[2]. Bankole, T. O. and L. Ogunkoya (1978). Introductory Organic Chemistry. Daystar press, Ibadan.

[3]. EIA, 2005. Petroleum supply annual 2004. http://www.eia.doe.gov/kids/index.ctm

[4]. Nelson, T. W. (1954). The Origin of Petroleum J. chem. Educ; 31:399-399.

[5]. Oseni, B. A. (2008). Applied statistics for managerial studies (revised Edition). Highland Publishers, Oyo state.

[6]. Rahaman Aliyu (2016). Descriptive and Inferential Statistics: An Introduction. Real success consults, Oyo state.

[7]. Wikipedia: Price of Oil. http://www.wikipedia.org/wiki/price_of_oil

[8]. Kaufmann, R.K., Dees, S., Karadeloglou, P., Sanchez, M. (2004). Does OPEC matter? And econometric analysis of oil prices. *The Energy Journal*, 25(4), 67-90.

[9]. Morana, C. (2001). A semiparametric approach to short-term oil price forecasting. *Energy Economics*, 23, 325-338.

[10]. Sadorsky, P. (1999). Oil price shocks and stock market activity. *Energy Economics*, 21, 449-469.