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Forecasting Election Results Using the Least Square Method: The APC Buhariyyah Regime

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ABSTRACT

The subject of regression analysis concerns the study of relationship among variables for the purpose of constructing models for prediction and making other inferences. This research work develops a mathematical model equation that helps in forecasting election results using Least Square Regression. Data on 2015 Nigeria Presidential election results were sourced from the Independent National Electoral Commission (INEC) to validate the model and result revealed the global usefulness of the model with standard error of 49.46 and coefficient of determination 0.064. the equation of the fitted regression line is $y = -0.226x + 59.78$*, with slope of -0.226.*

Keywords: *Buhariyyah, Using, Forecasting, Election, Square Method.*

Introduction

Mathematics has a versatile application but no branch of mathematics accentuates the versatility of its application like mathematical modeling. This is due to the fact that mathematical modeling has been found very indispensable in generating formulae to describe physical and non-physical phenomena in nature, with the use of numbers and figures to represent the phenomena.

A mathematical model of a complex phenomenon or situation has many of the advantages and limitations of other types of models. Some factors in the situation will be omitted while others are stressed. When constructing a mathematical model, the modeler must keep in mind the type of information he or she wishes to obtain from it. One of the most important aims for construction of models is to define the problem, such that only important details becomes visible, while irrelevant features are neglected.

Election is a procedure that allows members of an organization or community to choose representatives who will hold positions of authority within it. The most important elections select the leaders of the Local, State and National government. The chance to decide who will govern at these level serves as an opportunity for the public to make choices about the policies, programs, and future directions of government action. At this time, election promotes accountability. The threat of defeat at polls exerts pressure on those in power to conduct them in a responsible manner and take account of popular interests and wishes when they make their decisions.

The Independent Electoral Commission (INEC) first conducts voter's registration exercise prior to the general election. The electoral body uses these data obtained in the voter registration exercise to short list the names of citizens eligible to vote. The elections in this case are conducted using the secret ballot system. This research work ventured to forecast the election results in the presidential election to be conducted in Nigeria in 2019 under President Muhammadu Buhari's regime known as Buhariyyah regime.

The Voting Process and Forecasting of Election

At the end of every election, outcome of the voters decisions at polls are obtained. This outcome is what is called election result. The result comprise of the total number of votes casts, the vote casts for each candidate and invalid votes. Forecasting is the process of making statements about events whose actual outcomes (typically) have not yet been observed. A common place example might be estimation of some variable of interest at some specified future date.

Prediction is a similar, but more general term. Both might refer to formal statistical methods employing time series, cross-sectional or longitudinal data, or alternatively to less formal judgmental methods. Usage can differ between areas of application: for example, in hydrology, the terms "forecast" and "forecasting" are sometimes reserved for estimates of values at certain specific future times, while the term "prediction" is used for more general estimates, such as the number of times floods will occur over a long period.

Risk and uncertainty are central to forecasting and prediction; it is generally considered good practice to indicate the degree of uncertainty attaching to forecasts. In any case, the data must be up to date in order for the forecast to be as accurate as possible.

No matter how forecasters may predict, they seem to believe in prediction itself. In determining who will win an election, between two aspirants, hundreds of conditions determine which one will win. Leadership, organization, morale, manpower, history, population, and other factors take their toll of errors in any prediction outcome.

In forecasting an election, the predictor tries to reduce the hundreds of determining conditions to the smallest number of conditions he believes to be crucial. Sometimes he uses indicators, in addition to casual conditions, just as we use straws in the wind or an analysis of the behavior of air masses to forecast weather, the first being an indicator, the second being determining conditions.

The impulse to predict is irresistible. Man seeks assurance in the face of grave impending events. If we didn't try to predict elections, it probably would be a sign that we had little regard for the importance of election.

Elections in Nigeria are forms of choosing representatives to the Nigerian Federal Government and the various states in Nigeria. Nigeria has a multi-party system, with two recent strong political parties which include Peoples Democratic Party (PDP) and All Progressive Congress (APC) which is the amalgamation of Action Congress of Nigerian (ACN), All Nigeria Peoples Party (ANPP) and Congress for Progressive Change (CPC) at state level in late 2013.

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However, members of the Peoples' Democratic Party (PDP) have controlled the presidency and most states of the country since elections were resumed in 1999, until 2015 general election when All Progressive Congress (APC) took over the presidency, with majority in Legislative and Gubernatorial elections conducted by Independent National Electoral Commission (INEC) April, 2015.

In 2015 general election, fourteen (14) political parties contested for presidency, which include AA, ACPN, AD, ADC, APA, APC, CPP, HOPE, KOWA, NCP, PDP, PPN, UDP, UPP. Where the major two (2) political parties are All Progressive Congress with flag bearer Gen. Muhammadu Buhari and Peoples Democratic Party (PDP) with flag bearer Dr. Ebele Jonathan (GCFR) which was also the incumbent president, and the contestant from APC was emerged the winner.

The following factors explain the behavior of voters; ethnicity, income status, time, crisis, literacy level, religious differences among others. Many voters prefer candidates who share their own religious or ethnic background, people with good quality education and who have better orientation and experience with the electoral process and particularly the relevance of election to the improvement of their socio economic well-being will decide to vote for a more experienced and qualified candidates when compared with the educationally challenged and the less experienced persons. As regards to poverty, the use of money also influences voters' decision to vote.

Method

The secondary method of data collection was adopted to generate the past election results, other information are gotten through personal interviews, personal observations, and distribution of questionnaire.

The following data generated from the Independent Electoral Commission (INEC) database were considered and used for the research work.

TABLE 1: 2015 Presidential Election Result.

S/N 0	STATE	REGISTERE D VOTERS	ACCREDITED VOTERS	VALID VOTES	REJECTED VOTES	APC	PDP	OTHERS
1	ABIA	1,349,134	442,538	391,045	10,004	13,394	368,303	19,352
2	ADAMAWA	1,518,123	709,993	636,018	25,192	374,701	251,664	34,845
3	AKWA IBOM	1,644,481	1,074,070	1,017,064	11,487	58,411	953,304	16,836
4	ANAMBRA	1,963,427	774,430	688,584	14,825	17,926	660,762	24,721
5	BAUCHI	2,053,484	1,094,009	1,020,338	19,437	931,598	86,085	22,072
6	BAYELSA	605,637	384,789	367,067	4,672	5,194	361,209	5,336
7	BENUE	1,893,596	754,634	683,264	19,867	373,961	303,737	25,433
8	BORNO	1,799,669	544,759	501,920	13,088	473,543	25,640	15,825
9	CROSS RIVER	1,144,288	500,577	450,574	15,392	28,368	414,863	22,675
10	DELTA	2,044,372	1,350,914	1,267,773	17,075	48,910	1,211,405	24,533
11	EBONYI	1,071,226	425,301	363,888	29,449	19,518	323,653	3,590,166
12	EDO	1,650,552	599,166	500,451	22,334	208,469	286,869	27,447
13	EKITI	723,255	323,739	300,691	8,754	120,331	176,466	12,648
14	ENUGU	1,381,563	616,112	573,173	12,459	14,157	553,003	18,472
15	GOMBE	1,110,105	515,828	460,599	12,845	361,245	96,873	15,326
16	IMO	1,747,681	801,712	702,964	28,325	133,253	559,185	39,483
17	JIGAWA	1,815,839	1,153,428	1,037,564	34,325	885,988	142,904	42,997
18	KADUNA	3,361,793	1,746,031	1,617,482	32,719	1,127,760	484,085	38,356
19	KANO	4,943,863	2,364,434	2,128,821	43,626	1,903,999	215,779	52,669
20	KATSINA	2,842,741	1,578,646	1,446,646	32,288	1,345,441	98,937	37,336
21	KEBBI	1,457,763	792,817	677,003	38,119	567,883	100,972	46,267
22	KOGI	1,350,883	476,839	421,328	17,959	264,851	149,987	24,449
23	KWARA	1,181,032	489,360	440,080	21,321	302,146	132,602	26,653
24	LAGOS	5,827,846	1,678,754	1,443,686	52,289	792,460	632,327	71,188
25	NASARAWA	1,222,054	562,959	511,547	10,094	236,838	273,460	11,343
26	NIGER	1,995,679	933,607	813,671	31,012	657,678	149,222	37,753
27	OGUN	1,709,409	594,975	533,172	26,441	308,290	207,950	43,373
28	ONDO	1,501,549	618,040	561,056	21,379	299,889	251,368	31,178
29	OSUN	1,378,113	683,169	642,615	20,758	383,603	249,929	29,841
30	OYO	2,344,448	1,073,849	881,352	47,254	528,620	303,376	96,610
31	PLATEAU	1,977,211	1,076,833	982,388	18,304	429,140	549,615	21,937
32	RIVERS	2,324,300	1,643,409	1,565,461	19,307	69,238	1,487,075	28,455
33	SOKOTO	1,663,127	988,899	834,259	42,110	671,926	152,199	52,244
34	TARABA	1,374,307	638,578	579,677	23,039	261,326	310,800	30,590
35	YOBE	1,077,942	520,127	473,796	17,971	446,265	25,526	19,885
36	ZAMFARA	1,484,941	875,049	761,022	19,157	612,202	144,833	23,144
37	ABUJA	886,573	344,086	306,805	9,210	142,399	157,195	16,421
	TOTAL	67,422,006	31,746,460	28,584,844	843,887	15,420,921	12,853,162	4,697,859

Source: www.inec.org.ng (retrieved February 2016. 21:00)

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From table 1 above, the main political parties are; Peoples Democratic Party (PDP) and All Progressive Congress (APC) which performed meaningfully in the election, the winner won with 48.76 % of total valid votes cast. Votes for the remaining twelve (12) political parties were considered as others.

TABLE 2: Results Y_i in percentages for the political party that won the last election in Nigeria against other parties.

S/NO	STATE	APC (%)	PDP (%)	OTHERS (%)
1	ABIA	3.339742	91.83491	4.825346
2	ADAMAWA	56.66899	38.06113	5.269884
3	AKWA IBOM	5.67896	92.68417	1.636866
4	ANAMBRA	2.548446	93.9371	3.514456
5	BAUCHI	89.59784	8.279354	2.122808
6	BAYELSA	1.397217	97.16737	1.435416
7	BENUE	53.18511	43.19778	3.617107
8	BORNO	91.94867	4.978563	3.072768
9	CROSS RIVER	6.088782	89.04436	4.866862
10	DELTA	3.806676	94.28392	1.909409
11	EBONYI	0.49622	8.228458	91.27532
12	EDO	39.87662	54.87323	5.250151
13	EKITI	38.88607	57.02661	4.087318
14	ENUGU	2.417388	94.42841	3.154199
15	GOMBE	76.30153	20.46134	3.23713
16	IMO	18.20593	76.39964	5.394435
17	JIGAWA	82.65669	13.33198	4.01133
18	KADUNA	68.34077	29.33491	2.324323
19	KANO	87.64306	9.932532	2.424409
20	KATSINA	90.80302	6.6772	2.519785
21	KEBBI	79.41065	14.11955	6.469805
22	KOGI	60.29111	34.14328	5.56561

23	KWARA	65.48447	28.73899	5.776537
24	LAGOS	52.97281	42.26855	4.758636
25	NASARAWA	45.40249	52.42303	2.174484
26	NIGER	77.86369	17.66666	4.469646
27	OGUN	55.08986	37.15961	7.750535
28	ONDO	51.48884	43.15812	5.353044
29	OSUN	57.82614	37.67549	4.498374
30	OYO	56.92619	32.67005	10.40377
31	PLATEAU	42.88432	54.92349	2.192183
32	RIVERS	4.368968	93.8355	1.795531
33	SOKOTO	76.67158	17.367	5.961416
34	TARABA	43.35807	51.56658	5.075359
35	YOBE	90.76404	5.19163	4.04433
36	ZAMFARA	78.46943	18.56407	2.966499
37	ABUJA	45.06084	49.74289	5.196272
	TOTAL (%)	**48.75676 %**	**44.72973 %**	**6.486486 %**

The Least Square Method.

Various criteria might be used to estimate the coefficients in a model for experimental data. For each of p data points, we can define the error ε_j as the difference between the observation $y_j, j = 1,2,3,\dots,p$, and the predicted model response $\hat{y}_j$

$$y_j - \hat{y}_j = \varepsilon_j, \qquad j = 1,2,3,\dots,p \tag{1}$$

The independent variables in the vector x can be different variables or different functions of the same variable, such as $x, x^2, x^3, \dots$. The independent variables are assumed to be known exactly, or at least the error invoked in each element is substantially less than that involved in y.

A second criterion could be to sum the absolute values of the errors.

$$f_1 = \sum_{j=1}^{p} |\varepsilon_j| \tag{2}$$

Another criterion would be to minimize the absolute values of the maximum error. Both of these criteria can be used via library computer codes. However, the classical error criterion is the quadratic error summation.

$$f_2 = \sum_{j=1}^{p} \varepsilon_j^2 \qquad (3)$$

Criterion (2) is different from criterion (3), in that it weights large errors much more than extremely small ones in estimating the coefficients. If weights are included in the summation, we use

$$f_3 = \sum_{j=1}^{p} w_j \varepsilon_j^2 \qquad (4)$$

Now, we consider the linear model

$$y = \beta_0 + \beta_1 x \qquad (5)$$

To illustrate the principal features of the least squares method, to illustrate coefficients with $w_j = 1$. The objective function is:

$$f_2 = \sum_{j=1}^{p} (y_j - \hat{y}_j)^2 \qquad (6)$$

From (5), (6) becomes;

$$f_2 = \sum_{j=1}^{p} (y_j - \beta_0 - \beta_1 x_j)^2 \qquad (7)$$

There are two unknown coefficients $\beta_0 and \beta_1$, and p known pairs of experimental values of $y_j and x_j$.

To minimize f_2 with respect to $\beta_0 and \beta_1$, taking the first partial derivatives of (7) and equating them to zero gives

$$\frac{\partial f_2}{\partial \beta_0} = -2\sum_{j=1}^{p} (y_j - \beta_0 - \beta_1 x_j) = 0 \qquad (8a)$$

$$\frac{\partial f_2}{\partial \beta_1} = -2\sum_{j=1}^{p}(x_j)(y_j - \beta_0 - \beta_1 x_j)$$
$$= 0 \quad (8b)$$

Let a and b be the estimates of β_0 and β_1 respectively, obtained by solving equations (8a) and (8b),

Rearranging equation (8a) and (8b) gives:

$$\sum_{j=1}^{p} a + \sum_{j=1}^{p} bx_j = \sum_{j=1}^{p} y_j$$

$$a\sum_{j=1}^{p} x_j + b\sum_{j=1}^{p} x_j^2 = \sum_{j=1}^{p} x_j y_j$$

respectively.

Where

$$\sum_{j=1}^{p} a = ap, gives$$

$$ap + b\sum_{j=1}^{p} x_j = \sum_{j=1}^{p} y_j \quad (9a)$$

$$a\sum_{j=1}^{p} x_j + b\sum_{j=1}^{p} x_j^2 = \sum_{j=1}^{p} x_j y_j \quad (9b)$$

Introducing equation (10) into the objective function (6) gives

$$f_2 = \sum_{j=1}^{p} (y_j - \hat{y}_j)^2$$

$$= \sum_{j=1}^{p} (y_j - \sum_{i=0}^{n} \beta_i x_{ij})^2 \quad (11)$$

The independent variables are now identified by a double script, the first index designating the variables $(i = 0,1,2,3, \dots, n)$ and the second sequence of p data points $(j = 1,2,3, \dots, p)$. Next we differentiate f_2 with respect to $\beta_0, \beta_1, \dots, \beta_n$ and equate the (n + 1) partial derivatives to zero, obtained in (n+1) unknown values of the estimated coefficients $(b_0, b_1, \dots, b_n)$

$$\left.\begin{aligned}
b_0\sum_{j=1}^{p} x_{0j}^2 + b_1\sum_{j=1}^{p} x_{0j}x_{1j} + b_2\sum_{j=1}^{p} x_{0j}x_{2j} + \dots + b_n\sum_{j=1}^{p} x_{0j}x_{nj} &= \sum_{j=1}^{p} y_j x_{0j} \\
b_0\sum_{j=1}^{p} x_{1j}x_{0j} + b_1\sum_{j=1}^{p} x_{1j}x_{1j} + b_2\sum_{j=1}^{p} x_{1j}x_{2j} + \dots + b_n\sum_{j=1}^{p} x_{1j}x_{nj} &= \sum_{j=1}^{p} y_j x_{1j} \\
b_0\sum_{j=1}^{p} x_{2j}x_{0j} + b_1\sum_{j=1}^{p} x_{2j}x_{1j} + b_2\sum_{j=1}^{p} x_{2j}x_{2j} + \dots + b_n\sum_{j=1}^{p} x_{2j}x_{nj} &= \sum_{j=1}^{p} y_j x_{2j} \\
\dots\dots\dots\dots\dots\dots\dots\dots\dots\dots\dots\dots \\
\dots\dots\dots\dots\dots\dots\dots\dots\dots\dots\dots\dots \\
\dots\dots\dots\dots\dots\dots\dots\dots\dots\dots\dots\dots \\
b_0\sum_{j=1}^{p} x_{nj}x_{0j} + b_1\sum_{j=1}^{p} x_{nj}x_{1j} + b_2\sum_{j=1}^{p} x_{nj}x_{2j} + \dots + b_n\sum_{j=1}^{p} x_{nj}x_{nj} &= \sum_{j=1}^{p} y_j x_{nj}
\end{aligned}\right\} \quad (12)$$

This set of (n+1) equation in (n+1) unknowns can be solved in a computer using one of the many readily available routines for solving simultaneous equations.

Building and Analysis of the Forecasting Model

In building the forecasting model, least Square Regression Model which is developed from a set of data collected from the past election results conducted by Independent National Electoral Commission (INEC) will be used as in [1], [2], [3] and [4]. This model shall be built using the following procedures.

The Problem and Assumptions.

The problem is to build a mathematical model that can be used to forecast presidential election results in Nigeria. Based on the review of past research [5], assumed that the winning of any political party depends on a number of factors which include; income status, crisis, time, literacy level, religious differences, number of votes cast to other political parties, ethnic background, the candidate among others. In the cause of this research work, we shall consider the political party that won 2015 presidential election and some basic assumptions like the economic situations, incumbency (if any), the candidate's religion, candidate's geo-political zone, tribe, political history and family history.

Mathematical Formation

Putting the whole idea of forecasting the Presidential election results into a mathematical expression, gives;

$$Y_i = \beta_0 + \beta_1 P_i + \beta_2 C_i + \beta_3 S_i + \beta_4 T_i + \varepsilon_i \qquad i = 1,2,3 \ldots n. \qquad (13)$$

Where;

Y_i = Response (Parameter to be modeled).

P_i = number of votes obtained by the party that won the last election.

C_i = votes obtained by the political party that came second in the last election.

S_i = the sum of votes obtained by other political parties.

T_i= Total valid votes cast.

ε_i = the random error component.

and $\beta_0, \beta_1, \beta_2, \beta_3 and \beta_4$ are constants to be determined.

We then proceed to obtain the best fitting regression line using the least square approach.

Mathematical Analysis

The data in table 2 shall be used to manipulate and evaluate equation (13) in order to obtain the unknown constants.

In building the regression model, errors are inevitable, for each of the n-th data point, the error ε_i is the difference between the observations Y_i and the predicted response $\hat{Y}$

i.e. $\varepsilon_i = (Y_i - \hat{Y}_i) \qquad i = 1,2,3, \ldots n \qquad (14)$

Squaring both sides, we have

$\varepsilon_i^2 = (Y_i = \hat{Y}_i)^2$ (1

Since we seek the least value of error,

I

$$= min \sum_{i=1}^{n} (Y_i - \hat{Y}_i)^2$$

(16)

Putting equation (13) into equation (16) and letting a, b, c, d, and e be the estimate $\beta_0, \beta_1, \beta_2, \beta_3 and \beta_4$ respectively, gives

$$I = min \sum_{i=1}^{n} (Y_i - a - bP_i - cC_i - dS_i - eT_i - \varepsilon)^2 \quad (17)$$

To determine the values of a, b, c, d, and e in equation (17) above that gives the minimum error, we differentiate equation (17) partially with respect to a, b, c, d, and e, and their values are determined by solving the equations generated at the turning point. i.e. where the derivatives equal to zero independently.

Taking n = 37 (total number of state in Nigeria including the FCT).

Starting with a, gives

$$\frac{\partial I}{\partial a} = 2 \sum_{i=1}^{n} (Y_i - a - bP_i - cC_i - dS_i - eT_i)(-1) = 0$$

$$= -2 \sum_{i=1}^{n} (Y_i - a - bP_i - cC_i - dS_i - eT_i) = 0$$

$$\Rightarrow \sum_{i=1}^{37} Y_i = 37a + b \sum_{i=1}^{37} P_i + c \sum_{i=1}^{37} C_i + d \sum_{1=1}^{37} S_i + e \sum_{i=1}^{37} T_i \quad (18)$$

Similarly,

$$\frac{\partial I}{\partial b} = 2 \sum_{i=1}^{n} (Y_i - a - bP_i - cC_i - dS_i - eT_i)(-P_i) = 0$$

$$= -2\sum_{i=1}^{n} P_i(Y_i - a - bP_i - cC_i - dS_i - eT_i) = 0$$

$$\Rightarrow \sum_{i=1}^{37} P_iY_i = a\sum_{i=1}^{37} P_i + b\sum_{i=1}^{37} P_i^2 + c\sum_{i=1}^{37} P_iC_i + d\sum_{1=1}^{37} P_iS_i + e\sum_{i=1}^{37} P_iT_i \quad (19)$$

Similarly

$$\frac{\partial I}{\partial c} = 2\sum_{i=1}^{n}(Y_i - a - bP_i - cC_i - dS_i - eT_i)(-C_i) = 0$$

$$= -2\sum_{i=1}^{n} C_i(Y_i - a - bP_i - cC_i - dS_i - eT_i) = 0$$

$$\Rightarrow \sum_{i=1}^{37} C_iY_i = a\sum_{i=1}^{37} C_i + b\sum_{i=1}^{37} C_iP_i + c\sum_{i=1}^{37} C_i^2 + d\sum_{1=1}^{37} C_iS_i$$

$$+ e\sum_{i=1}^{37} C_iT_i \quad (20)$$

Similarly,

$$\frac{\partial I}{\partial d} = 2\sum_{i=1}^{n}(Y_i - a - bP_i - cC_i - dS_i - eT_i)(-S_i) = 0$$

$$= -2\sum_{i=1}^{n} S_i(Y_i - a - bP_i - cC_i - dS_i - eT_i) = 0$$

$$\Rightarrow \sum_{i=1}^{37} S_iY_i = a\sum_{i=1}^{37} S_i + b\sum_{i=1}^{37} S_iP_i + c\sum_{i=1}^{37} S_iC_i + d\sum_{1=1}^{37} S_i^2$$

$$+ e\sum_{i=1}^{37} S_iT_i \quad (21)$$

Similarly,

$$\frac{\partial I}{\partial e} = 2\sum_{i=1}^{n}(Y_i - a - bP_i - cC_i - dS_i - eT_i)(-T_i) = 0$$

$$= -2\sum_{i=1}^{n} T_i(Y_i - a - bP_i - cC_i - dS_i - eT_i) = 0$$

$$\Rightarrow \sum_{i=1}^{37} T_iY_i = a\sum_{i=1}^{37} T_i + b\sum_{i=1}^{37} T_iP_i + c\sum_{i=1}^{37} T_iC_i + d\sum_{1=1}^{37} T_iS_i + e\sum_{i=1}^{37} T_i^2 \qquad (22)$$

From the output, the following sets of simultaneous equations were obtained;

$37a + 15420921b + 12853162c + 4697859d + 32971942e = 1804 \qquad (23)$

$$15420921a + (2.37805E + 14) + b(1.98208E + 14)c + (7.24453E + 14)d + (5.08458E + 14)e = 27819341484 \qquad (24)$$

$$12853162a + (1.98208E + 14)b + (1.65204E + 14)c + (6.03823E + 14)d + (4.23794E + 14)e = 23187104248 \qquad (25)$$

$$4697859a + (7.24453E + 13)b + (6.03823E + 13)c + (2.20699E + 13)d + (1.54898E + 14)e = 8474937636 \qquad (26)$$

$$32971942a + (5.08458E14)b + (4.23974E + 14)c + (1.54898E + 14)d + (1.08715E + 18)e = 59481383368 \qquad (27)$$

Using matrix inverse method to solve for the value of a, b, c, d and e, gives

$a = -2.5969E - 05$

$b = 4.14384E - 05$

$c = 9.06379E - 05$

$d = -9.07456E - 11$

$e = -1.50854E - 11$

Substituting the values of a, b, c, d and e, into equation (13), gives

$$\hat{Y}_i = (2.5969E-05) - (4.14384E-05)P_i - (9.06379E-05)C_i + (9.07456E-11)S_i + (1.50854E11)T_i \quad (28)$$

Model Testing

Two tests shall be conducted, namely;

1. Conduct t-test on the individual β parameters in the model, and
2. Test the global usefulness of the model (Analysis of variance; F-test).

t-test

To conduct the t-test, we consider the following steps:

a) Test hypothesis

The hypothesis of interest concern the parameter β_4 especially, we consider the null hypothesis (*Ho:* that the model terms are unimportant in predicting Y) against the alternative hypothesis (*Ha:* that at least one of the model terms are useful in predicting Y)

$$Ho: \beta_4 = 0$$

$$Ha: \beta_4 \neq 0$$

b) Test Statistics

Since the standard deviation σ for the random error component ε is usually unknown, the appropriate test statistic is a t-statistic, formed as follows;

$$t = \frac{e - o}{Se}$$

The estimates (e of β_4) as well as the calculated t-value in the Coef, Stdev, and t-ratio columns respectively gives.

$$t = \frac{-1.50854E - 11}{4.17859E05} = -3.61017E - 07$$

$$\Rightarrow |t| = 3.61E - 07$$

c) Rejection region

$$t < -t\alpha or |t| > t_{\alpha/2}$$

To find the rejection region, using the student t-distribution table gives the value of t. The value is used to construct the rejection region for the two tailed test. For $\alpha = 0.05, n - (k + 1) = 25 - (4 + 1) = 20df.$

The critical t-value obtained from the student t-table is, $t = 2.015$ and the lower tail$= -2.015$. The rejection region is $t = -3.61E - 07 < t_{0.05} = -2.015$.

Since the test statistics value, $t = -3.61E - 07$ falls in the rejection region, we have sufficient evidence to reject Ho, and accept the alternative hypothesis Ha: $\beta_4 \neq 0$ and conclude that the model parameters are useful for predicting Y.

We have the standard error ε as 49.46, which imply that the model is fairly accurate. The coefficient of determination $(r^2) = 0.064$ is interpreted as 6.4% of the sample variation in Y can be "explained" by $using P_i, C_i, S_i, and\ T_i$ in the first order model,

$$Y = \beta_0 + \beta_1 P_i + \beta_2 C_i + \beta_3 S_i + \beta_4 T_i + \varepsilon_i \qquad i = 1,2,3, \dots n$$

TABLE 3: Standard Error

S/NO	STATE	APC (%)	PREDICTED VALUE (%)	ERROR (E)	REMARK
1	ABIA	3.339742	33.93720264	-30.5975	increase
2	ADAMAWA	56.66899	38.33726728	18.33172	decrease
3	AKWA IBOM	5.67896	88.82588799	-83.1469	increase
4	ANAMBRA	2.548446	60.63286601	-58.0844	increase
5	BAUCHI	89.59784	46.40645053	43.19139	decrease
6	BAYELSA	1.397217	32.95442421	-31.5572	increase
7	BENUE	53.18511	43.02639045	10.15872	decrease
8	BORNO	91.94867	21.94678483	70.00189	decrease

9	CROSS RIVER	6.088782	38.77780058	-32.689	increase
10	DELTA	3.806676	111.8259098	-108.019	inconclusive
11	EBONYI	0.49622	30.14361184	-29.6474	increase
12	EDO	39.87662	34.6397892	5.236831	decrease
13	EKITI	38.88607	20.98079999	17.90527	decrease
14	ENUGU	2.417388	50.70963756	-48.2922	increase
15	GOMBE	76.30153	23.74974559	52.55178	decrease
16	IMO	18.20593	56.20510463	-37.9992	increase
17	JIGAWA	82.65669	49.66639756	32.99029	decrease
18	KADUNA	68.34077	90.60896346	-22.2682	increase
19	KANO	87.64306	98.45636406	-10.8133	increase
20	KATSINA	90.80302	64.72031254	26.08271	decrease
21	KEBBI	79.41065	32.68401199	46.72664	increase
22	KOGI	60.29111	24.56947357	35.72164	decrease
23	KWARA	65.48447	24.53917827	40.94529	decrease
24	LAGOS	52.97281	90.15101086	-37.1782	increase

25	NASARAWA	45.40249	34.59999305	10.8025	decrdential the
26	NIGER	77.86369	40.77825061	37.08544	decreasete. 1
27	OGUN	55.08986	31.62315729	23.4667	decrease
28	ONDO	51.48884	35.2103504	16.27849	decrease
29	OSUN	57.82614	38.54889558	19.27724	decrease
30	OYO	56.92619	49.40248181	7.523708	decrease
31	PLATEAU	42.88432	67.59878133	-24.7145	increase
32	RIVERS	4.368968	137.6544146	-133.285	**inconclusive**
33	SOKOTO	76.67158	41.63849217	35.03309	decrease
34	TARABA	43.35807	38.9991528	4.358917	decrease
35	YOBE	90.76404	20.80609542	69.95794	decrease
36	ZAMFARA	78.46943	38.49599049	39.97344	decrease
37	ABUJA	45.06084	20.14857919	24.91226	increase
	TOTAL (%)	**48.76274 %**	**48.7567573 %**	**0.221209**	

SUM OF ERRORS = 0.221209

$$= \sum_{i=1}^{n} \varepsilon_i = 0.221209$$

$SUM\ OF\ SQUARES\ OF\ ERROR = 78296.05$

$$= \sum_{i=1}^{n}(Y_i - \hat{Y}_i)^2 = 78296.05$$

$MEAN\ SQUARE\ OF\ ERROR$

$$= MSE = \frac{i=\sum_{i=1}^{n}(Y_i-\hat{Y}_i)^2}{df} = \frac{78296.05}{32} = 2446.75$$

$STANDARD\ ERROR\ OF\ RESIDUE$

$$= \sqrt{MSE} = \sqrt{2446.75} = 49.46$$

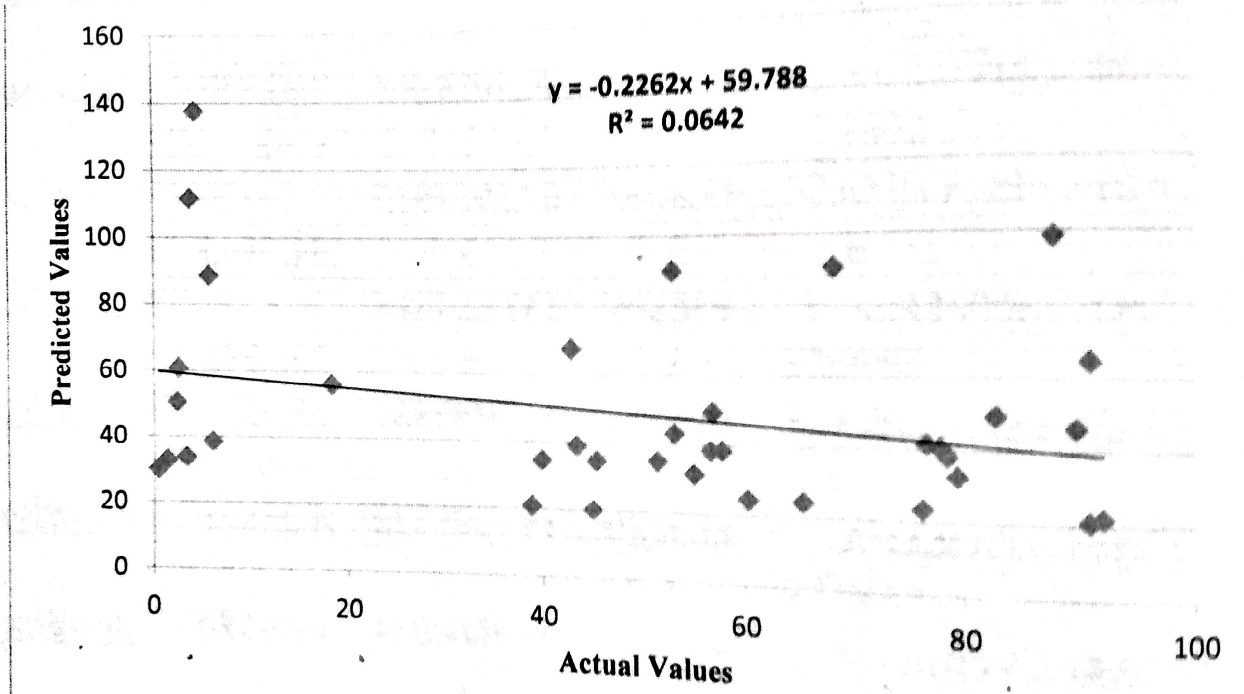

Figure 1: Regression Graph of best Fit

Conclusion

After proving that the overall model is useful for predicting Y using F-test, t-test was also conducted to test one of the most important (β_i's) parameter. (*i.e.* β_4). We limit the number of t-test conducted to avoid the potential problem of making too many errors.

From the indicator, (ie. $R^2 = 0.064$ with negative slope -0.226) shows that All Progressive Congress (APC) has 93.6% (i.e. 100% − 6.4%) chance of repeating what happened in 2015, if every other factors and methods considered in 2015 presidential election is to hold. Other basic assumptions that may affect the predicted outcome of 2019 presidential election in Nigeria include: the geo-political zone of the candidate, the religion of the candidate, tribe of the candidate and the running mate, gender of the candidates, pre-campaign information, candidate political history, voting behaviour towards the party, incumbency.

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