# FORECASTING NIGERIA'S ECONOMIC DEVELOPMENT: EMPIRICAL ANALYSIS OF AGRICULTURE, INDUSTRY AND SERVICES USING MINITAB 20.2.0 SOFTWARE (FROM 1981 TO COVID-19)

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**Abstract**

This paper attempt to investigate on Nigeria's economic growth. In the pursuit to understand the contribution and effect of GDP on its components namely; Agriculture, Industry and Services by considering there growth rate from their respective exponential growth curves models. While Yearly Data were sources from CBN website www.cbn.gov.ng span from 1981 to 2019 of real sector statistics. Minitab 20.2.0 software was used to accomplish the task of the key economy sectors. A, such Beverton-Holt Economic Recruitment model was applied in other to check the economic growth rate over the period. The model shows that GDP, Agriculture, Services follows unlimited growth Pattern while, industry follows logistics growth Pattern through the various sector trend respectively. Further findings shows that exponential standard measures of forecast accuracy with, 26 MAPE, 2727 MAD and 2181586115 MSD means services sector and industry sector value had the best smaller model fit. The regression estimates on Agriculture 65.9%, R-sq(adj) of 99.30%, Industry 98.1% R-sq(adj) 97.48% and Services 83.3%, R-sq(adj) of 99.31% measures the goodness of fit and has a positive coefficient determination statistically improved also meaning that all the regression model is approximately significant for this key sectors respectively, the variance inflation factor (VIF) measures the effect of collinearity among the component in the regression model. VIF is 1/tolerance in addition, the tolerance value is exactly 1, and this further substantiates the absence of multicollinearity in the study. Based on these key findings, the study therefore conclude and recommends that service sector, industrial sector and agricultural sector on the overall GDP respectively played a significant role as it affect the economic development in Nigeria. Hence, Beverton-Holt Economic Recruitment model can be used in modeling macroeconomic time series. Fits and Diagnostics forecast shows value between 2020 to 2023 indicating that Nigeria's economy is in take off stage, GDP and other component measure will exhibit's a sigmoidal growth curve that will begins rapidly before year 2025



ISSN NUMBER: 1116-249X

**Keywords:** Beverton-Holt Economic Recruitment; Forecast Nigeria economy

## 1. Introduction

According to Ramonu (2023), in current years, mathematicians and statisticians have progressively utilized machine learning software. Suffices to say that; programme environment on statistical methodologies and analytical tools after adapting data to solve the problems of all human endeavor especially in Nigeria.

These adopted statistical methods are usually termed as machine learning, such methods are adjusted so that they become appropriate for the measurement of stochastic relationships and predictions of future observations (Ramonu, 2023). These adjustments basically attempt to specify stochastic element which operate in economic real-world data and enters into the determination of observed data (Ramonu, 2023).

While, Evborokhai, et.al, (2012), and so on had pointed out that the progress of the quality of life of the people due to the increase of the national income and the volume available goods and services is refers to economic development. The determinants of Nigeria economic growth have attracted increasing attention in both practices, theoretical and applied research while much of the growth in an economy is explained by changes in the number of natural resources, expenditure, revenues and money supply among others economic factors (Evborokhai, et.al, (2012).

Nigeria is the most populous Black Country in Africa. A tropical country in the Gulf of Guinea, between Benin and Cameroun and is richly endowed with vast natural resources amongst which are Natural Gas, Petroleum, Tin, Iron Ore, Coal, Limestone, Niobium, Lead, Zinc, and Arable land. Her oil reserve is the ninth largest in the world and this is put at 18 billion barrels. The nation has unexplored with Agricultural which have been ranked fifth largest in the world.

Yet, there is still high rate of poverty and infrastructural under- development in the country. Nigeria's current economic growth rate is put at 8% by the International Monetary Fund (IMF) for 2021 ( Odueme, 2021). This growth is sustained by high oil prices which account for over 80% of Nigeria's foreign exchange earnings.

Thus, Nigerians economic answer is obvious. This is because it is the engine that drives economic development activities of every nation and it is also a major tool needed by the government to achieving its Millennium Development Goals (MDGs) and accomplishing its target of being one of the top twenty economies of the world in year 2020 as enshrined in its Vision 20:2020 agenda.



ISSN NUMBER: 1116-249X

However, with the ever-dynamic nature of economics science, the paradigm has shifted from just attaining economic growth, to a more environmentally concerned sustainable economic growth. This means less relevance is being given to improving productive capacity at the expense of the environmental well-being.

This connotes that goals of nations have now transcended to achieving an economic growth level, which does not hinder that of the coming generation. This is termed sustainable economic growth, and in it is the huge presence of environmental preservation as well as conservation of natural resources. The usefulness of economic sectors in Nigeria in achieving this goal of sustainable economic growth cannot be overemphasized, and has been perceived and held by various studies in the statistical literature. Over the years, changes in revenue generation have had effects on important indicators in the Nigerian economy.

At the end of 2019 in Wuhan, the high technology business hubs of China experience an epidemic of an entirely distinctive coronavirus appeared that had killed a few thousand Chinese within the fifty days of spreads and thousands of other citizens are suffered. The novel virus was nominated as COVID-19 novel coronavirus by the Chinese scientists (Shereen et al. 2020). Later on, in a shorter period, this COVID-19 spread worldwide. Country' like, Nigeria economy's growth among others is severely affected due to COVID19 outbreak.

Further, the outbreak has changed the operating conditions all over the globe within a month. The confirmation of these COVID19 movements not happening by chance in a different period thereby presents a problem to as whether the movements in country revenue are the effect imposers on sustainable growth. This therefore leads to the following questions that this study seeks to answer. Such, Time series data give information about the numerical values of variables from time to period and are collected over equal time and interval (Ramonu, 2023). For example, the data during the years 1981-2021 for economic development of Nigeria annual government basic expenditure fact constitutes a time series data.

According to Romer and Paul (2016), this enables the data to be called as annual periodic random sample data which is needed for the application of statistical tools. Regression analysis was used in this study, one of the very important roles of econometrics is to provide the statistical policy tools for modeling on the basis of economic given data. Thus, the regression modeling technique is a statistical tool which helps a lot in this task.



ISSN NUMBER: 1116-249X

The regression models adopted growth curve based on which we have non-linear regression analysis. (Schelling and Thomas, 2018) We will consider only the tools of linear regression analysis and our main interest will be the fitting of prediction regression model to a given economic development set of observation in Nigeria. Thus; this obtained models are used for forecasting Nigeria economic development variable which include Agriculture, Industry and Services which, were measure on gross domestic product GDP at basic price in billions of Naira and policy decision formulation which is an essential part in the study. Such that forecasts help the policy makers to judge the goodness fit of model and take necessary measures in order to re-adjust the relevant Nigeria economic development variables.

This study adopted machine learning use of Minitab machine to model GDP Nigeria at basic price on macroeconomic variable for development in Nigeria. Also, the study would mean to attempt and investigate growth trend curve, formulate economic development policy determine among economic variable namely Agriculture, Industry and Services respectively, the effect on modeling. Weather Total GDP Nigeria promotes economic development or otherwise to which appropriate policy recommendation. Still, the outstanding section of the investigation is presented as follows: Section 2 literature review; Section 3 is the method, Section 4 presents result and discussion while Section 5 concludes and policy recommendation of empirical study.

## 2. Literature Review

This study reviews the literature of the research. It consists of Conceptual Review, Theoretical framework. The review will convey greatly on fact and figures obtained from purchased published reference materials such as books, online publications and journals. The evaluation will provide an overview of foremost evidence on past activities that had earlier been studied in relation to the research.

### 2.1 Conceptual Reviews

Under economic philosophy GDP per capital exactly equals the gross domestic income (GDP) per capital. GDP was first developed by Simon Kuzuets for a US congress report in 1934; we immediately said not to use it as a measure for welfare. After the Breton woods conference in 1934, GDP became the main tool for measuring a country's economy. Agreeing to Akinbolola (1999), Gross Domestic Product (GDP) is the market value of all officially recognized final goods and services produced within a country in a given period.



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### 2.1.2 Economy Sectors of Nigeria

Nigeria economic growth can be determined in three ways; all of which should in standard give the same result. They are the product (or output) approach, the income approach and the expenditure approach. There are many sectors affecting the Nigeria economic but, in this research, only three sectors will determine and the contribution of each of the GDP component namely agriculture, industry and services (Ramonu, 2021). In term of expenditure there was slit slow fluctuation in this index of welfare between 2014 and 2019 on the Nigeria economic development.

### 2.1.3 Agriculture Sector

Agricultural sector has been an important sector in the Nigerian economy in the past decades, and is still a major sector despite the oil boom; basically it provides employment opportunities for the teeming population, eradicates poverty and contributes to the growth of the economy. Nigeria rank 1$^{st}$ in Africa and 25$^{th}$ in world farm output (Ramonu, 2016).

### 2.1.4 Industry Sector

Industrial Sector oil and gas export accounted for more than 98% of export earnings and about 83% of federal government revenue (Scherer, 2019). New oil wealth the concurrent decline of other economic sectors State and local governments demanded access to this “windfall” revenue, creating a thug-of-war between the federal governments, which sought to control spending, and state governments during augmented budgets, preventing the government from making provision for lower oil prices. The price of US investment is nearly billion dollars, mostly in the energy sector; exon mobile and chevron are the two largest US corporations in off shore oil and gas production. Significant exports of liquefied gas started in late 1999 (Ramonu, 2016).

### 2.1.5 Services Sectors

Nigeria ranks 4$^{th}$ in Africa and 56$^{rd}$ worldwide in service output, low power and telecom density have crippled the growth of this sector. Since undergoing distress in the mid 1900’s. Nigeria’s banking sector has witnessed significant growth over the last few years as new bankers enter into the financial market. Harsh monetary policies implemented by the central bank of Nigeria to absorb excess liquidity in the economy has made life more difficult for banks, some of whom engage in currency arbitrage (round-tripping) activities that generally fall outside legal banking mechanisms. Private sectors led economic growth remains stymied by the high cost of doing business in Nigeria, including the need to duplicate essential infrastructure, the threat of crime and



ISSN NUMBER: 1116-249X

associated need for security counter measures, the lack of effective due process, and non-transparent economic decisions marking, especially in government contracting (Ramonu, 2021).

## 2.2 Theoretical Review of Economic Development

### 2.2.1 Forecasting model

Suppose the outcome of any process is denoted by a random variable $y$ , called as dependent (or study) variable, depends on $k$ independent (or explanatory) variables denoted by $X_1, X_2,\ldots, X_k$.

Suppose the behaviour of $y$ can be explained by a relationship

given by $\boldsymbol{y = f(X_1, X_2,\ldots, X_k, \beta_1,\beta_2,\ldots,\beta_k)+\varepsilon}$ …… **(1)**

The parameters can be computed using Hamilton's (2019) filter as estimation method.

Where $f$ is some well-defined function and $\beta 1, \beta 2,\ldots,\beta_k$ are the parameters which characterize the role and contribution of $X_1, X_2,\ldots, X_k$, respectively.

The term $\varepsilon$ reflects the stochastic nature of the relationship between $y$ and X1, $X_2,\ldots, X_k$ and indicates that such a relationship is not exact in nature.

When $\varepsilon = 0$, then the relationship is called the mathematical model otherwise the statistical model.

The term "**model**" is broadly used to represent any phenomenon in a mathematical frame work.

A model or relationship is termed as linear if it is linear in parameters and nonlinear, if it is not linear in parameters. In other words, if all the partial derivatives of y with respect to each of the parameters $\beta_1,\beta_2,\ldots,\beta_k$ are independent of the parameters, then the model is called as a **linear model**.

On the other hand, $\boldsymbol{y = \beta_1^2 X_1 + \beta_2 X_2 + \beta_3 \log X + \varepsilon}$ **……..(2)**

is a nonlinear model because $\partial y / \partial \beta_1 = 2\beta_1 X_1$ depends on $\beta_1$ although $\partial y / \partial \beta_2$ and $\partial y / \partial \beta_3$ are independent of any of the $\beta_1,\beta_2$ or $\beta_3$.

When the function $f$ is linear in parameters, then $y = f(X_1, X_2,\ldots, X_k, \beta_1,\beta_2,\ldots,\beta_k)+\varepsilon$ is called a linear model and when the function $f$ is nonlinear in parameters, then it is called a nonlinear model.

In general, the function $f$ is chosen as $f(X_1, X_2,\ldots, X_k, \beta_1,\beta_2\ldots,\beta_k) = \beta_1 X_1 \beta + {}_2 X_2 \ldots + \beta + {}_k X_k$ to describe a linear model.

Since $X_1, X_2,\ldots, X_k$ are pre-determined variables and $y$ is the outcome, so both are known.

Thus the knowledge of the model depends on the knowledge of the parameters $\beta_1,\beta_2,\ldots,\beta_k$.

The statistical linear modeling essentially consists of developing approaches and tools to determine $\beta_1,\beta_2,\ldots,\beta_k$ in the linear model $y = \beta_1 X_1 \beta + {}_2 X_2 \ldots + \beta + {}_k X_k \varepsilon +$ given the observations on $y$ and $X_1, X_2,\ldots, X_k$.



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Different statistical estimation procedures, e.g., method of maximum likelihood, principle of least squares, method of moments etc. can be employed to estimate the parameters of the model.

The method of maximum likelihood needs further knowledge of the distribution of y whereas the method of moments and the principle of least squares do not need any knowledge about the distribution of $y$. The regression analysis is a tool to determine the values of the parameters given the data on $y$ and $X_1, X_2,\ldots, X_k$.

The literal meaning of regression is "to move in the backward direction

Depending on the form of the function $f$ and the nature of phenomenon. So ideally, the pre-existing model gives rise to the data. Our objective is to determine the functional form of this model. Now we move in the backward direction. We propose to first collect the data on study and explanatory variables. Then we employ some statistical techniques and use this data to know the form of function $f$. equivalently, the data from the model is recorded first and then used to determine the parameters of the model.

The regression analysis is a technique which helps in determining the statistical model by using the data on study and explanatory variables. The classification of linear and nonlinear regression analysis is based on the determination of linear and nonlinear models, respectively.

Consider a simple example to understand the meaning of "regression". Suppose the yield of crop ( $y$ ) depends linearly on two explanatory variables, viz., the quantity of a fertilizer ($X_1$) and level of irrigation ($X_2$) as

$$y = \beta_1 X_1 + \beta_2 X_2 + \varepsilon \ldots\ldots\ldots \quad (3)$$

There exist the true values of $\beta_1$ and $\beta_2$ in nature but are unknown to the experimenter. Some values on $y$ are recorded by providing different values to $X_1$ and $X_2$. There exists some relationship between $y$ and $X_1$, $X_2$ which gives rise to a systematically behaved data on $y$, $X_1$ and $X_2$. Such relationship is unknown to the experimenter. To determine the model, we move in the backward direction in the sense that the collected data is used to determine the unknown parameters $\beta_1$ and $\beta_2$ of the model. In this sense such an approach is termed as regression analysis.

The theory and fundamentals of linear models lay the foundation for developing the tools for regression analysis that are based on valid statistical theory and concepts (Tufte, (2012).



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### 2.2.2 Basics Steps in forecasting analysis

According to Murray and Spiegel (2008), Regression analysis includes the following steps; Statement of the problem under consideration, Choice of relevant variables, Collection of data on relevant variables, Specification of model, Choice of method for fitting the data, Fitting of model, Model validation and criticism And Using the chosen model(s) for the solution of the posed problem. The validation of the assumptions must be made before drawing any statistical conclusion. Any departure from validity of assumptions will be reflected in the statistical inferences. In fact, the regression analysis is an iterative process where the outputs are used to diagnose, validate, criticize and modify the inputs.

### 2.2.3 Beverton- Holt Recruitment Growth model

According to Ramonu (2023) in line with (Geoffrey and Andrew, 2007). Propend a model of economic growth rate curve which is refers to as Beverton- Holt Economic Recruitment Growth Curve (BHERGC) thus, variable such as Agriculture, industry and services exhibit a density dependent from one product to next. Let Greater than (>) 1 be the net reproductive rate. That is, the number of exciting production percent, let x >0 be the density of independent variable x and y be the density of exciting production y (dependent). Thus, the Beverton- holt economic recruitment growth curve becomes;

$$y = \frac{Rx}{1 + (R - 1/K)X}$$

Were K>0 is the carrying capacity of the Specific economic variable.
Y means economic dependency Total Output of Gross Domestic Product (GDP GR).
X means economic independency Total Input of Agriculture, Industry and Services
econometric quantities grow in proportion to both their present magnitude and their distance from an upper and lower limit M. this differential equation functions governing growth model, such model include, unlimited, limited and logistics model. Were all subject to rate of change in an economic over the time period. If one of these differential equation governs a particular situation, we can assume immediately, evaluating the constants from the give fact. Thus, the three mathematical models applies in a situation, which varies whether the growth is proportional to magnitude, to unused capacity, or to both models trend. (Ramonu, 2023). This model applied



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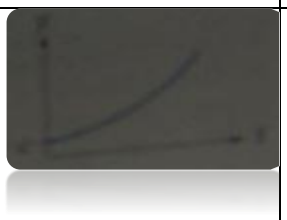
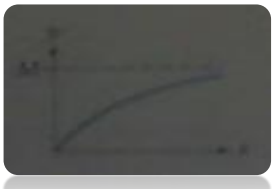
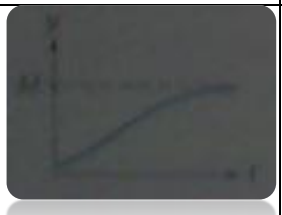
assumption is associated to the real sector of Nigeria economy and in line with the measure on carrying capacity of economic growth (development) rate. Hence; Economist often believed that an economic grows in proportion to both its present size and its distance to estimated national expenditure and revenue, or income over time.

**Table 1: Model of Economic Recruitment Growth Rate Curve**

| **Growth Rate Model Type** | **Differential Equation** | **Solution** | **Trend/Graphical Pattern** | **Example Of Economic Components** |
|---|---|---|---|---|
| **Unlimited**; Growth is proportional to present size of economic variable | Y*=ay | $Y=ce^{at}$ |  | GDP GR Agriculture Services |
| **Limited**; Growth start at 0 is proportional to maximum size M minus present size of economic variable | Y*=a(M-y) | $Y=M(1-e^{-at})$ |  | |
| **Logistic**; Growth is proportional to present size and maximum size M minus present size of economic variable. | Y*=ay(M-y) | $Y=\frac{m}{1+ce^{-amt}}$ |  | Industry |

**Source: Ramonu (2023).**

The unlimited, limited and logistics growth models differential equation and solution nomenclature were summarize below thus;

Y* means Rate of Growth

ay means proportion to Economic Variable present size number infect

M-y means number susceptible upper and lower limit M

a>0 and c>+, -1 means Positive or Negative constant function



ISSN NUMBER: 1116-249X

M means a sigmoidal or S-shaped curve which is model growth that begins slowly, then becomes more rapid.

**Proportional Quantities;** we say one economic quantity is proportional to another quantity if the first quantity is a constant multiple of the second. That is, y is proportional to x if y=ax for some economic variable "proportionality constant" a.

## 3. Methods

### 3.1 Data and Statistics

**Research Design**

Research design refers to how this research is planned and carried out. The research designed used by the researcher is secondary sources estimation method. The data gathering from an already made national bodies.

**Source of Data**

Real life regular observation on some basic collection is a very significant aspect in any statistical investigation for any meaningful study can be done, thus annual time series data and sourced from the website and statistical bulletin respectively.

The data spanned from 1981 to 2019 from Central Bank of Nigeria (CBN) and National Bureau of Statistics respectively Central bank of Nigeria website (2022). Data was not converted to natural fact on the regression model. Time Series Data may be collected at regular time intervals, such as daily, weekly, monthly [ (CPI)], quarterly (e.g., GDP data), annually basis.

### 3.2 Assumptions of Time Series

According to Adenomon (2016), some of the assumptions of time series are;

1. Stationary: the first assumption is that the series are stationary; this means that the series are normally distributed and the mean and variance are constant over a long period of time.
2. Uncorrelated random error: it is assume that the error term relating to any observation is not influenced by the error term relating to any other observation in the time series data.
3. No outliers: it is expected that there is no outlier in the series. Outliers may strongly affect the conclusion and can lead to misleading results.
4. Random shocks: if shocks are present in the series. They are assumed to be randomly distributed with a mean of zero and constant variance.



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### 3.3 Model Specification

**Simple Linear Curve**

$\mathbf{Y_t = \alpha + \beta_t + e_t}$ ……. (1)

Where

$\mathbf{Y_t}$ = dependent variable GDP (time in trend analysis)

$\boldsymbol{\alpha}$ = the trend value time zero i.e. intercept

$\boldsymbol{\beta_t}$ = change in trend per unit time of Agricultural, industries and services at i.e. slope

$\mathbf{e_t}$ = irregular fluctuation away from trend line at time t i.e. error term.

$\boldsymbol{\alpha = \overline{Y} - \overline{\beta t}}$

$\boldsymbol{\beta = \frac{n(\sum t - \sum y \sum t)x^2}{n\sum t^2 - (\sum t)^2}}$

**Exponential Curve**

The simple linear describes a constant amount of growth or decline many economic and business series exhibit a constant role of change rather than constant amount of change. Such values are in geometric rather than arithmetic progression. These value lie on an exponential curve. The exponential growth trend model accounts for exponential growth or decay. For example, a savings account might exhibit exponential growth. The model is:

Thus, $Y_t$ is plotted against time and in this case will not produce a linear trend.

The mathematical form of exponential curve is: $\mathbf{Y_t = b_0 * b_1^t * e_t}$

$\mathbf{Y_t = \alpha \beta^t}$ ……. (2)

Where;

$\boldsymbol{\alpha = \log^{-1}(\frac{\sum logY}{n})}$

$\boldsymbol{\beta = \log^{-1}(\frac{\sum x logY}{\sum x^2})}$



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### 3.4 Standard Measures of Accuracy

Winters seasonal exponential smoothing is an interactive process in which we smooth the data using different combination of the weight. The combination that produce the smallest MAPE, MAD, MSD which means; mean absolute percentage, mean absolute deviation and mean square deviation respectively.

Adenomon (2016), point out that winter's seasonal exponential smoothing technique can be employed with the smoothing process in three periods. They include to estimate the average level, to estimate the slope component and to estimate the seasonal component of the time series. As such the winter's method is able to account for some error in the forecast by the updating procedure the equations of the winter's method are as follows

Thus, Minitab computes three measures of accuracy of the fitted model: MAPE, MAD, and MSD. The three measures are not very informative by themselves, but you can use them to compare the fits obtained by using different methods. For all three measures, smaller values generally indicate a better fitting model.

### 3.5 Method of Data Analysis

The data collected through the secondary sources were analyzed with the use of the machine learning Minitab 20.2.0 version for windows software. The paper objective were too analyzed with analysis of regression model on Nigeria Economic Development data. The data collected were subjected to statistical analysis in order to estimate the best linear unbiased estimator (BLUE). In other to accept or reject the empirical fact. Still, inferential statistics was also used to test the expressed stated sectors independency.

## 4. Results and Discussions

This study result is presented below in both descriptive in time plots and inferential statistical modeling thus; the results of the simple linear regression modeling, robust fit equaling of means model outcomes as well as the upright estimate diagnostics significant in calculating the validity of the expected model.

### 4.1 Descriptive statistics

#### 4.1.1 Analysis on Time plot of the various sectors on Nigeria's Economic Growth

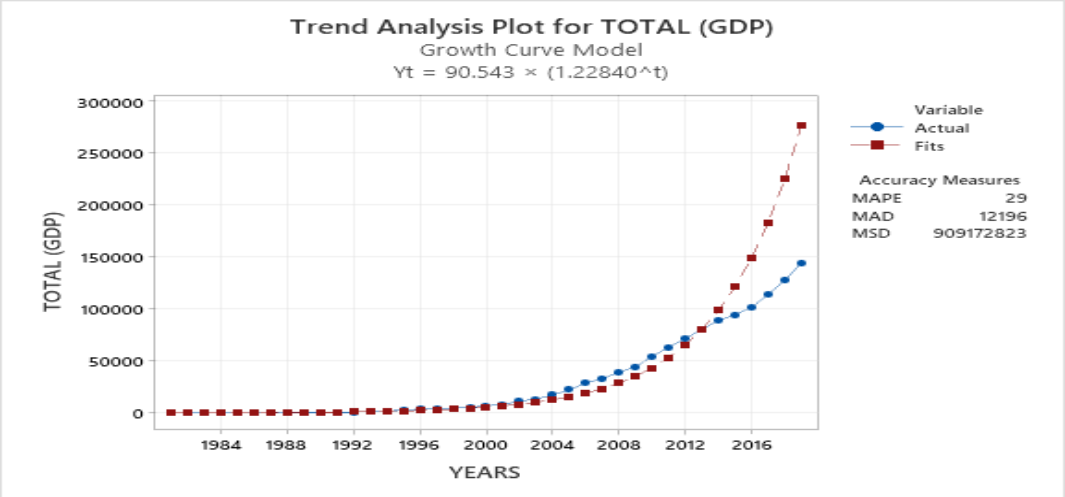
The first step in building time series models using Minitab software entails a detailed analysis of the characteristics of the individual economic development time series variables involved. Some important characteristics of time series can be seen through the time series plot or time plot. Time



ISSN NUMBER: 1116-249X

series plots are often used to examine effects on seasonal or annual variations, or before-and-after effects of a process economic change. Time series plots are especially useful for this study to comparing data patterns of different groups Nigeria economic variable growth curves. Therefore, it is significant to obtain a good understanding of the individual economy growth curve movement measures.

**Figure 1: Trend Analysis Plot of Nigeria's GDP from 1981 to COVID 1**




**Sources: Minitab software output (2023).**

This figure 1 above depicts the trend analysis of GDP measures with accuracy of the fitted Standard Measures of Accuracy thus, it was clearly observed that 29 MAPE, 12196 MAD, and 909172823 MSD which means that estimate of GDP average level, and the slope of GDP component at basic price trend. Though as indicated earlier, GDP trend contribution to Nigeria economic growth which have been so impressive from 1981 to 2004, the growth rate of GDP very unstable from 2005 to date. The highest growth rate of GDP was experienced in 2018 from actual fit. Hence there is a need for a lot more consistency and coordination by Nigeria's GDP armament through the other economic sector.



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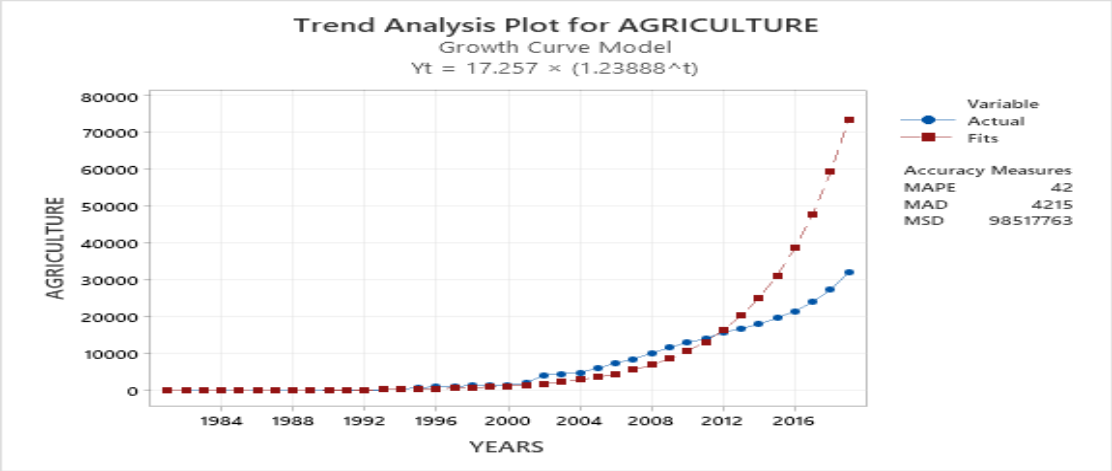
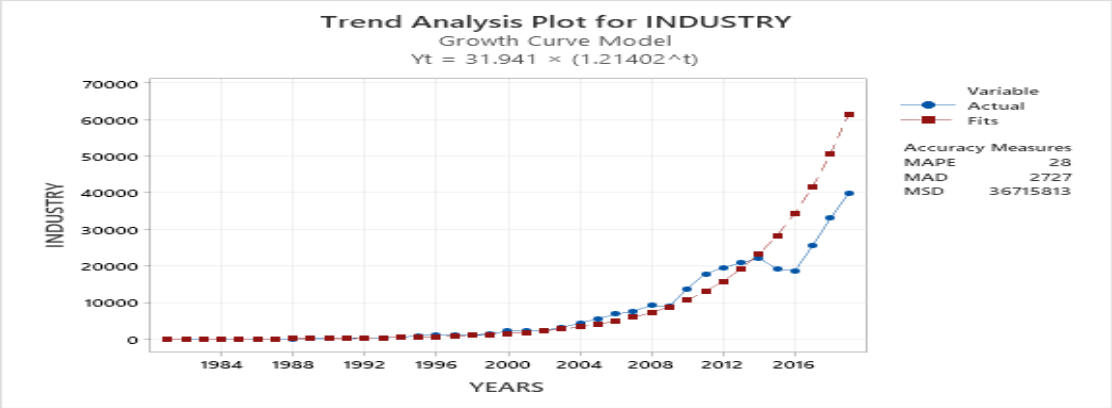
**Figure 2: Trend Analysis Plot of Nigeria's Agriculture sector from 1981 to COVID 19**




**Sources: Minitab software output (2023).**

This figure 2 above examines the trend analysis of Agricultural sector in Nigeria the considerations of the significant sector and it challenges to economic growth. it was clearly observed that 42 MAPE, 4215 MAD, and 98517763 MSD which means that estimate of Agricultural average level, As shown in above agricultural sector exhibits no threatening from 1981 to 2003 as the trend shows very stable behaviors with less trend of generally from 2004 characterized with steady growth year-on-year which is a sign of policy makers as it implies that over the sector. Which still maintain some considerable stability and hence it can be depended upon in the forecasting coordination. This has been empirically shown that agricultural sector is less susceptible to shocks because it is consumption based.

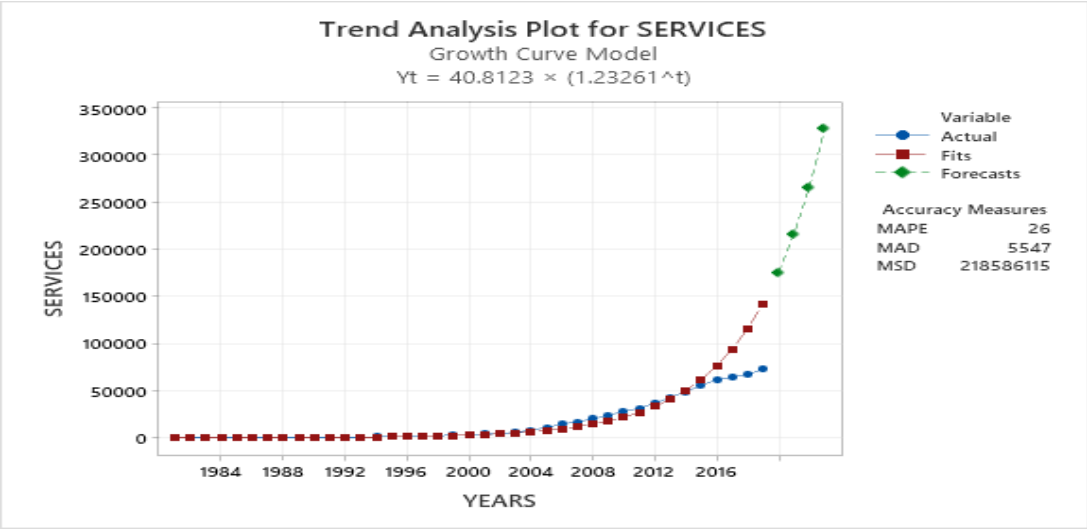
**Figure 3: Trend Analysis Plot of Nigeria's Industrial sector from 1981 to COVID 19**




**Sources: Minitab software output (2023).**

This figure 3 above shows the trend analysis of industrial sector in Nigeria the contribution of the sector over the study period. As observed, the estimated average contributions of 28 MAPE, 2727 MAD, and 36715813 MSD have been so unstable from 2004 to 2016 and meshed with fluctuation and this may be expected due to lack of efficiency and low monitoring levels of the sector management authorizes and several loop-holes associated with industrial policy reforms.

**Figure 4: Trend Analysis Plot of Nigeria's Services sector from 1981 to COVID 19**




**Sources: Minitab software output (2023).**

This figure 4 above present the trend analysis of services sector in Nigeria the as observed, the estimated average contributions of 26 MAPE, 5547 MAD, and 218586115 MSD. Through the sharp spikes in 1981 to 2008 very stable deviations, the trend of services and the rate of change for the sectors is impressive. While from 2009 more corrupt practices are endemic, they are generally less flagrant than during military rule through it trend, and there are signs of improvement. Meanwhile justice as a means to foster corporate growth remains underutilized by Nigeria's services sector.

**Table 2: Compering Between Standard Measures of Accuracy**

| Nigeria Economic Sectors | Exponential Growth curve Estimate | MAPE | MAD | MSD |
|---|---|---|---|---|
| **AGRICULTURE** | $yt = 17.257\times (1.23888\text{^} ** t)$ | 42 | 4215 | 9817763 |
| **INDUSTRY** | $yt = 31.941\times (1.21402\text{^} ** t)$ | 28 | 2727 | 36715813 |
| **SERVICES** | $yt = 40.8123\times (1.23261\text{^} ** t)$ | 26 | 5547 | 218586115 |
| **TOTAL(GDP)** | $yt = 90.543\times (1.2284\text{^} ** t)$ | 29 | 12136 | 909172823 |

**Sources: Author Computation (2023). Minitab output.**

**Keynote: since** all three numbers are lower for the exponential trend model compared to the linear method; therefore, the exponential trend model seems to provide the better fit. However, It is a noted fact that, the combination that produces the smallest weights **MAPE, MAD or MSD** in the optimal set of weight. The smaller the value, the better the fit of the model, Adenomon, (2016). Such, services sector and industry sector had the best fit exponential measures of forecast accuracy. Since the total GDP and its component assume exponential growth curve the growth model for each of the variables.

**4.2 Inferential Statistics**

**Econometric Techniques Regression Analysis were adopted for Total GDP, Agriculture, Industry and Services Sectors in Nigeria**

In this analysis we used a exponential regression model, to estimate the effect of prediction on various economy growth rate in Nigeria as variable. while proxy is determined related to choice of variable evidenced in making judgment (Ramonu, 2021), This study used Dependent Variable were Total GDP and proxy for our independent variable were, Agriculture, industry and services. This were regressed against GDP measure economic growth the functional form on our econometric model is given thus;

### 4.2.1 Regression Analysis: TOTAL (GDP) versus AGRICULTURE

**Table 3: Coefficients**

| Term | Coef | SE Coef | T-Value | P-Value | VIF |
|---|---|---|---|---|---|
| Constant | -1767 | 710 | -2.49 | 0.017 | |
| AGRICULTURE | 4.6588 | 0.0634 | 73.50 | 0.000 | 1.00 |

**Table 4: Model Summary**

| S | R-sq | R-sq(adj) | R-sq(pred) |
|---|---|---|---|
| 3481.82 | 99.32% | 99.30% | 99.25% |

**Sources: Minitab software output (2023).**

**Regression Equation** TOTAL (GDP) =-1767 + 4.6588 AGRICULTURE

From table 3 and 4 the regression equation reveals a statistically insignificant relationship between GDP, Agriculture sector. The estimation of this equation shows a negative intercept with -1767 which implies that when agricultural sector are zero, GDP would not stand at -1767 with p-value of 0.017. However, the Slope of the estimated model shows positive with 65.88% with P-value of 0.000 stands statistically significant relationship between GDP and Agriculture sector. Which means 1 unit change in Agriculture sector would cause GDP to change by 4.6588 units in the same direction. R-Square adjusted with 99.30% which means that Agriculture sector contribution to GDP growth rate improved significantly and means that 99.30% of the total variation in GDP is accountable by Agriculture. The variance inflation factor (VIF) measures the effect of collinearity among the component the regression model. VIF is 1/tolerance in addition, the tolerance value is exactly 1, and this further substantiates the absence of multicollinearity.

**Table 5: Analysis of Variance**

| Source | DF | Adj SS | Adj MS | F-Value | P-Value |
|---|---|---|---|---|---|
| Regression | 1 | 65487878218 | 65487878218 | 5401.94 | 0.000 |
| AGRICULTURE | 1 | 65487878218 | 65487878218 | 5401.94 | 0.000 |
| Error | 37 | 448552426 | 12123039 | | |
| Total | 38 | 65936430645 | | | |

**Table 6: Fits and Diagnostics for Unusual Observations**

| Obs | TOTAL (GDP) | Fit | Resid | Std Resid | | |
|---|---|---|---|---|---|---|
| 40 | 44286 | 52394 | -8108 | -2.37 | R | |
| 41 | 89044 | 82178 | 6865 | 2.04 | R | |
| 42 | 127737 | 125751 | 1986 | 0.62 | | X |
| 43 | 144210 | 146868 | -2658 | -0.87 | | X |

**Sources: Minitab software output (2023).**

*R Large residual*

*X Unusual X*

*P-value < 0.05 = statistical significant.*

*F*rom table 5 and 6 shows analysis of variance ANOVA. This is used to investigate the possibility of a significant difference between two or more variable groups. The annual measures statistics F-value of 5401.94 and p-value of 0.000 shows that there is a significant difference between the various measures as presented above. Consequently, as expected we accept that there is a significant difference between the GDP and Agriculture measures over the years. We can also infer from the economic growth context that agricultural sector also contributed positively to Nigeria's economic development. Hence, Fits and Diagnostics for Unusual Observations forecasting test shows that agriculture sector will further exhibit's positive contribution to Nigeria economic growth from 2020 to 2023 evidence from the above Diagnostics GDP Nigeria values.

### 4.2.2 Regression Analysis: TOTAL (GDP) versus INDUSTRY

**Table 7: Coefficients**

| Term | Coef | SE Coef | T-Value | P-Value | VIF |
|---|---|---|---|---|---|
| Constant | 746 | 1312 | 0.57 | 0.573 | |
| INDUSTRY | 3.981 | 0.104 | 38.39 | 0.000 | 1.00 |

**Table 8: Model Summary**

| S | R-sq | R-sq(adj) | R-sq(pred) |
|---|---|---|---|
| 6606.50 | 97.55% | 97.48% | 96.92% |

**Sources: Minitab software output (2023).**

**Regression Equation** TOTAL (GDP) =746 + 3.981 INDUSTRY

From table 7 and 8 the regression equation reveals a statistically significant relationship between GDP, Industrial sector. The estimation of this equation shows a positive intercept with 746 which implies that when Industrial sector has effect on GDP. This would stand at 746 with p-value of 0.573. The Slope of the estimated model shows positive with 98.1% with P-value of 0.000 stands statistically significant relationship between GDP and Industrial sector. Any 1 unit change in Industrial sector would cause GDP to change by 3.981 units in the same direction. R-Square adjusted with 97.48% which means that Industrial sector contribution to GDP growth rate improved significantly. The VIF tolerance value is exactly 1, and this further substantiates the absence of multicollinearity.

**Table 9: Analysis of Variance**

| Source | DF | Adj SS | Adj MS | F-Value | P-Value |
|---|---|---|---|---|---|
| Regression | 1 | 64321534264 | 64321534264 | 1473.71 | 0.000 |
| INDUSTRY | 1 | 64321534264 | 64321534264 | 1473.71 | 0.000 |
| Error | 37 | 1614896381 | 43645848 | | |
| Total | 38 | 65936430645 | | | |

**Table 10: Fits and Diagnostics for Unusual Observations**

| Obs | | TOTAL (GDP) | Fit | Resid | Std Resid | | |
|---|---|---|---|---|---|---|---|
| 40 | | 94145 | 77138 | 17007 | 2.65 | R | |
| 41 | | 101489 | 74959 | 26530 | 4.13 | R | |
| 42 | | 127737 | 132993 | -5256 | -0.88 | | X |
| 43 | | 144210 | 159513 | -15303 | -2.74 | R | X |

**Sources: Minitab software output (2023).**

*R Large residual*

*X Unusual X*

*P-value < 0.05 = statistical significant.*

*F*rom table 9 and 10 present analysis of variance ANOVA. F-value of 1473.71 and p-value of 0.000 shows that there is a significant difference between the various measures as presented above. Consequently, as expected we accept that there is a significant difference between the GDP and Industrial sector measures over the years. We can also infer from the economic growth context that Industrial sector also contributed positively to Nigeria's economic development. Hence, Fits and Diagnostics for Unusual Observations forecasting test shows that industry sector will exhibits' positive contribution to Nigeria economic growth from 2020 to 2023 evidence from the above Diagnostics GDP Nigeria values.

### 4.2.3 Regression Analysis: TOTAL (GDP) versus SERVICES

**Table 11: Coefficients**

| Term | Coef | SE Coef | T-Value | P-Value | VIF |
|---|---|---|---|---|---|
| Constant | 984 | 683 | 1.44 | 0.158 | |
| SERVICES | 1.8334 | 0.0248 | 73.99 | 0.000 | 1.00 |

**Table 12: Model Summary**

| S | R-sq | R-sq(adj) | R-sq(pred) |
|---|---|---|---|
| 3459.04 | 99.33% | 99.31% | 99.12% |

**Sources: Minitab software output (2023).**

**Regression Equation** TOTAL (GDP) =984 + 1.8334 SERVICES

From table 11 and 12 the regression equation reveals a statistically significant relationship between GDP, services sector. The estimation of this equation shows a positive intercept with 984 which implies that when services sector has effect on GDP. This would stand at 984 with p-value of 0.158. The Slope of the estimated model shows positive with 83.34% with P-value of 0.000 stands statistically significant relationship between GDP and services sector. Any 1 unit change in services sector would cause GDP to change by 1.8334 units in the same direction. R-Square adjusted with 99.31% which means that Industrial sector contribution to GDP growth rate

improved significantly. The VIF tolerance value is exactly 1, and this further substantiates the absence of multicollinearity.

**Table 13: Analysis of Variance**

| Source | | DF | Adj SS | Adj MS | F-Value | P-Value |
|---|---|---|---|---|---|---|
| Regression | | 1 | 65493728068 | 65493728068 | 5473.81 | 0.000 |
| SERVICES | | 1 | 65493728068 | 65493728068 | 5473.81 | 0.000 |
| Error | | 37 | 442702577 | 11964935 | | |
| Total | | 38 | 65936430645 | | | |

**Table 14: Fits and Diagnostics for Unusual Observations**

| Obs | TOTAL (GDP) | Fit | Resid | Std Resid | | |
|---|---|---|---|---|---|---|
| 40 | 94145 | 102405 | -8260 | -2.52 | R | |
| 41 | 101489 | 113415 | -11925 | -3.70 | R | |
| 42 | 127737 | 124089 | 3648 | 1.15 | | X |
| 43 | 144210 | 133768 | 10442 | 3.35 | R | X |

**Sources: Minitab software output (2023).**

*R Large residual*

*X Unusual X*

*P-value < 0.05 = statistical significant.*

*F*rom table 13 and 14 shows analysis of variance ANOVA. F-value of 5473.81 and p-value of 0.000 shows that there is a significant difference between the various measures as presented above. Consequently, as expected we accept that there is a significant difference between the GDP and services sector measures over the years. We can also infer from the economic growth context that services sector also contributed positively to Nigeria's economic development. Hence, Fits and Diagnostics for Unusual Observations forecasting test shows that services sector will exhibit's

positive contribution to Nigeria economic growth from 2020 to 2023 evidence from the above Diagnostics GDP Nigeria values.

### 5.1 Conclusion and Recommendations

This study concludes that services, Agriculture and industry respectively are the key contributor to Nigeria economic growth since findings shows that there have highest growth rate.

The value of $R^2$ adjusted which is 99.30 Agricultural, 97.48 Industry and 99.31 Services respectively gives the variation in GDP (Real Gross Domestic Product) that is explained by independent components or variables. The higher the $R^2$ adjusted, the better the fitted model. The overall model is statistically significant which implies that we are having positive economic growth. From the findings, it shows that there is no presence of multicollinearity and on checking for the presence of heteroscedasticity, it shows that the disturbance term is not heteroscedastic. There is also an absence of serial correlation in this study.

It is realized further, according to Beverton- Holt Economic Recruitment Growth Curve that Nigeria economy is presently in S-shaped curve which is model growth that begins slowly, then becomes more rapid over the economic variable. As such it is also a noted fact that any country economic that services sector and industry sector has the optimum Standard measurement accuracy contribution to the GDP is still developing.

The Beverton- Holt Economic Recruitment Growth Curve approach to time series analysis and control is very good for all component of GDP with the use of Minitab Machine learning Software. Therefore, time series model is suitable for modeling Nigeria's economic components and contributors which include; Agriculture, industrial, service and total GDP of Nigeria.

Economic development point out that Nigeria's economy is presently of more than one leading sectors which are services sector, industrial sector and agricultural sector respectively.

Finally. It was found that agricultural sector, industrial sector, service sector and overall GDP played a significant role as it affect the economic growth in Nigeria. Also, the theory of economic development revealed that Nigeria economy is currently in take off stage and actually developing.

### 5.2 Policy Recommendations

It is however recommended based on this research findings that;

- The Central Bank of Nigeria should come out with stable policy guideline to enable the commercial banks disburse loans to people at a very moderate interest rate, in order to help them expand their production technology, economic capacity.

- Training more on SME's and IDCs. Extension workers to educate citizens in the use of modern production techniques to help boost the country's economic production capacity and development.
- Establishment of more research institute to improve for seasonal economic products as means of improving the country's Agricultural output.
- Nigerian's people should ignore political instability, economic mismanagement, corruption and other negative factors on Nigeria economy.
- Government should stimulate the adoption of mechanized agricultural tools, such as automated planting and harvesting systems, to enhance productivity in Nigeria
- Government should also increase its expenditure on rural and stable electricity as this will fast-track the productive sector as well as raise the standard of living of unfortunate citizens in Nigeria.
- Lastly, considering the significant of this services sectors to economic growth and development, the sectors should strive to improve by attracting increase in trading activities. In other words, deepening the capital market, and also credit control by the CBN should be more effective to channel credits to more productive core sectors.

**Acknowledgments**

The authors wish to appreciate the review support received from JRSSNG, the Minitab companies for the Right to use and for providing innovative and predictive analytics software and Central Bank of Nigeria, National Bureau of Statistics for supplying the data and other information necessary that helped modeling this empirical evidence and various anonymous reviewers for their contribution towards this investigation.

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