



A Study of Inflation Trend Pattern and Its Impact on Nigeria's Economy

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ABSTRACT

In this research the trend on the rate of inflation in Nigeria so as to be able to make future forecast and to check the pattern of the effects of inflation rate on the economy. The data used is secondary, based on the annual publication of the National Bureau of Statistics. The statistical tools used are Trend analysis, and One-way Anova. In the trend analysis, a linear trend model and exponential trend model were fitted, and the best fitted model was the exponential trend model that has a minimum Mean Absolute Deviation of 0.2961. The best fitted model was used to forecast the inflation rate for two years and it revealed that the inflation is increasing. The one-way Anova test carried out showed that there is significant difference between the years of inflation in Nigeria. A post-hoc test was carried out that revealed the years that differ. Also, the purchasing power of the Nigeria currency, Naira, was carried out over the years, and it is seen that the purchasing power is decreasing, which revealed that the inflation is really affecting the economy. Based on these findings, it is advisable that the government should create policies and programmes that will help in controlling inflation. Reduction of income tax and Value Added Tax (VAT) will help curb poverty and bring down the price of goods and services. Finally, there is a need to improve on the security state of the country which is one of the major factors influencing the increase in the prices of goods in Nigeria.

KEY WORDS: Trend, Stationary, Exponential Model, Mean Absolute Deviation, Model

1.0 INTRODUCTION

Inflation is defined as a general increase in prices and fall in purchasing value of money. High and sustained output growth in conjunction with low inflation is the common objective of macroeconomic policy all over the world. Though a frequently used term among discussants on issues of macroeconomic importance, the nature and causes of inflation remain largely debatable. However, there appears a near convergence of opinion among economists that inflation refers to sustained increase in general price level. By implication, this expression indicates that inflation does not refer to a one-off increase in price but to a continuous one. It also indicates that for a price increase to qualify as inflationary, it should not be an isolated case or an increase in a single item or selected items but must operate at the aggregate level, cutting across sectors of the economy.

Inflation is a problem in all facets of life and in all economic entities. The government of any nation is concerned with the responsibility of ensuring that her plans and programmed are not frustrated by unpredictable and galloping prices. Every firm desires a stable macro-economic environment that is devoid of unrepentant price change that can bring about reliable forecast and planning. An individual also strives that he is not worse off by unexpected price increase. All these bring home the need to explore the study of inflation so as to form a timeless and dependable model of its tendency.

In Nigeria, the problem of inflation is attributed to the global pandemic (Covid-19), low-capacity utilization, devaluation of currency, unemployment and under employment, a fallen Gross Domestic Product (GDP) and also a fallen standard of living.

Furthermore, because of the adverse consequences of inflation on the social economic sectors of the country, government decided to introduce different measures in order to adjust the problem such as strict fiscal policies, Structural Adjustment Programme (SAP). Tight monetary policies, budget discipline, and guarded deregulation, in order to eradicate the problem of inflation in Nigeria.

2.1 LITERATURE REVIEW

Many attempts have been made to study the pattern of inflation in Nigeria. Asogu (2022), undertook an empirical investigation based on ten different specifications that covered monetary, structural and open economic aspects of inflation. Variables used in the regressions include money supply and its lagged value, real GDP and its lagged value, aggregate domestic credit to the economy and its lagged value, government expenditure and its lagged value. Others are Industrial production index, import price index and the official exchange rate.

All variables were expressed in terms of their rate of change. In all the models estimated, the character of inflation seems to be well captured. Real output had the right signs in all the models, but was significant in all the equations where they featured. In summary, the results of the estimation suggested that output, especially industrial output, net export currency money supply, domestic food price and exchange rate change were the major determinant of inflation in Nigeria. The study therefore confirms the importance of the structural character of the economy, open economy and monetary aspects of inflationary trend in Nigeria.

In another study, Moser (2020) identifies the main determinants of inflation in Nigeria present both in long run model and in dynamic error correction model, and discusses the implications of the results. He analysed the determinant factors influencing inflation in Nigeria. An error correction model of the inflation process was developed based on money market equilibrium conditions. All the coefficient estimates had their expected signs. The monetary effect was quite large and significant at the one per cent level while real income and the exchange rate were also significant at that level. Rainfall on the other hand, had no significance in the long run. In addition to the above estimates of the structural parameters in a long run role relationship, Moser also estimated a dynamic version specified as an error correction model.

The model utilizes information in the error term from the equilibrium and represents the short run response necessary to move the system backwards towards its equilibrium. The result of the analysis confirms the basic findings that monetary expansion, driven mainly by expansionary fiscal policies, explained to a large degree the inflationary process in Nigeria. Other important factors are the devaluation of naira and agro climatic conditions. It was found that concurrent fiscal and monetary policies had a major influence on the impact of the depreciation of the naira on inflation.

The study by E. Essien and M. K. Chau (2021) also produced evidence that output growth and exchange rate, to a significant extent, influence price level in Nigeria. The study used the estimation technique of vector auto-regression (VAR) and presents further shows that currency depreciation or devaluation and agro-climatic conditions are equally important factors. The results confirm that inflationary condition in Nigeria is largely the result of expansionary fiscal policies, which drive the expansion of monetary variables.

Inimole and Enoma (2018) used the autoregressive distributed lag (ARDL) to study how inflation is affected by exchange rate depreciation in the Nigerian economy. The study identified money supply, depreciation of exchange rate, and real output as significant drivers of inflation in the country. An earlier study by Fakiyesi (2020) based on the estimation technique of ARDL also showed that monetary growth, exchange rate depreciation, real GDP growth, rainfall, and level of anticipated inflation significantly affect inflation in Nigeria.

T. Imbaka and M. O. Phillips (2019) also did a study on Causes and Effects of Inflation in Nigeria and it was discovered that change in money supply, credit to government by banking system, government deficit expenditure, industrial production and food price indices are underlined factors that contribute to inflationary tendencies in Nigeria. Also, increase in government expenditure financed by monetization of oil revenue and credit from banking system could also be responsible for the expansion of money supply which in turn (with lagged effect) contributes to inflationary tendencies.

2.2 EFFECTS OF INFLATION

Sitar (2021), in the investigation of causes and effects of rate of inflation on prices and interest, discovered that inflation affects the cost of any goods or services in an economy — including major purchases like homes and cars; consumer goods like food and televisions; personal services from construction to health care; and financial services like banking, loans, and credit cards. Dana also discussed the major common effects of inflation:

- **Depreciation:** The most immediate effects of inflation are the decreased purchasing power of money and its depreciation. Depreciation is especially hard on retired people with fixed incomes because their money buys a little less each month. Those not on fixed incomes are more able to cope because they can simply increase their fees.
- **Prices Rise:** The most obvious effect of inflation is higher prices on everyday goods and services. That means a higher cost of living, but also generally higher wages.
- **Interest Rates Go Up:** To keep inflation from rising out of control, the federal government typically raises the market interest rate to increase the cost of borrowing money and keep from pumping too much money into consumers' hands and spiking demand and prices.
- **Debt is Cheaper:** If the inflation rate is greater than your interest rate on debt, you benefit by repaying the debt with less-valuable money. In countries that don't manage interest rates as the U.S. does, debt becomes cheaper with inflation, which can accelerate inflation further.
- **Saving is Deterred:** If the inflation rate is higher than the yield on a savings account or the return on investments, consumers are incentivized to spend now rather than save money that will lose purchasing power over time.
- **Laying off Staff and Increase in Unemployment;** inflation can cause consumers and investors to change their spending habits. When inflation occurs, people tend to spend less, meaning that factories have to lay off workers because of a decline in orders.

3.1 METHODOLOGY

In this Chapter the statistical analysis has to be carried out using the appropriate methods in order to obtain meaningful result in any statistical analysis. The methods of analysis to be used is determined by the data while the method suggest the appropriate design to be used for the computation of the data.

3.2 SOURCES OF DATA COLLECTION

Data are numerical information collected for reference, analysis and decision making. They are material used for every statistical investigation; therefore the authenticity of any statistical analysis depends largely on the data used.

Data on social and economic statistics are obtained from two main sources; Published and unpublished source. The sources can be further classified into two; National and International Sources.

National Sources include statistical abstract bulletin and reported issue by statistical units of government department. The most elaborate sources of national published data are the statistical abstract or statistical digest published annually by National Bureau of Statistics.

The data used in this project work is secondary. It is the national published data on Inflation Rate in Nigeria extracted from the statistical abstract published annually by the National Bureau of Statistics.

3.3 STATISTICAL TOOLS USED

Base on the aims and objectives of this project, the statistical tools used are;

1. Time Series Analysis (Trend Analysis)
2. One Way Analysis of Variance

3.4 TIME SERIES ANALYSIS

Time series is a set of observations taken at specific times, usually at equal intervals. It is a series of data point indexed in time order. Time series analysis is a specific way of analysing a sequence of data points collected over an interval of time. In time series analysis, analysts record data points at consistent intervals over a set period of time rather than just recording the data points intermittently or randomly. Examples of time series are total annual production of crude oil in Nigeria over a number of years, the daily price of commodities sold in the market etc.

Mathematically, a time series is defined by the values y_1, y_2, y_3, \dots Of a variable Y (price, temperature etc) at times t_1, t_2, t_3, \dots

Thus $Y = f(t)$ i.e Y is a function of t .

3.4.1 Importance of time series

The analysis of time series is of great significance for the following reasons:

- It helps in understanding past behavior.
- It helps in planning future operations.
- It helps in evaluating current accomplishments.
- It facilitates comparison.

3.4.2 Components of Time Series

Fluctuations of a time series may be classified into four basic types of variations which accounts for changes in the series over a period of time. These fluctuations are due to the influence of physical, economic, sociological, and other forces. Analysis of these movements helps in forecasting future movements. These components are:

- 1) **Secular Trend:** This refers to the general direction in which the graph of a time series appears to be going over a long interval of time. For example a secular trend which shows upward movement is population trend, death rate-downward trend etc.
- 2) **Cyclical Variation:** This is the recurrent up and down wave like variations from secular trend. These circles may or may not be periodic. Example is business cycles (representing intervals of prosperity, recession, depression and recovery).
- 3) **Seasonal Variation:** This is a variation in a time series within one year that is repeated more or less regularly. It is the up and down variations from secular trend that occur within a year and reoccur annually. This may be caused by climate and weather condition, social customs, religious activities, public holidays etc.
- 4) **Irregular Variation:** This refer to the erratic or sporadic motions of time series due to chance events such as floods, strikes etc. Though such events produce variations lasting only a short time, it is conceivable that they may be so intense as to result in new cyclical or other movements.

3.4.3 Forecasting in Time Series

This is the process of estimating future values of numerical parameters on the basis of the past. It is also a technique that uses historical data as inputs to make estimates that are predictive in determining the direction of future trends.

3.4.4 Trend Analysis

This is a statistical technique that tries to determine future movements of a given variation by analyzing historical trends. It is a method that aims to predict future behaviours by examining past ones. The term trend is sometime referred to as a secular trend. It is the long term “drift” of a series of data. For example, the Gross Domestic Product (GDP) of a Country may grow at a fairly constant rate over a period of time, although there may be year to year quarter to quarter and even month to month fluctuations in the GDP around the long term drift or trend. One of the most important forces reflected in trend is population growth. As the total population of a country grows, so does the demand for goods and services, as well as the aggregate production of goods and services. Trend may be either linear or non-linear.

3.5 ONE-WAY ANALYSIS OF VARIANCE

The one-way analysis of variance (ANOVA) is used to determine whether there are any statistically significant differences between the means of two or more independent groups we are going to consider only one method which is the One-way ANOVA.

One-Way Analysis of Variance (ANOVA) is a method for splitting total variation of our data into the meaningful component that measures the sources of variation. One-way Analysis of Variance can be characterized when a named population represent different variations of a single factor, example, type of food crops grown in a farm land, high school attendant by students, type of disease treated, etc.

The model usually used in carrying out analysis in One-way analysis of variance is given as follows:

$$Y_{ij} = \mu + t_i + e_{ij} \dots \dots \dots (3.1)$$

Where: i = 1, 2,, p; j = 1, 2,, n

$$e_{ij} \square N(0, \sigma^2)$$

y_{ij} = is the observed yield
μ = is the mean effect

t_i = is the treatment effect

e_{ij} is the experimental error assumed normally and independently distributed with mean equal 0 and variance σ².

$$SST = \sum_{i=1}^p \sum_{j=1}^n y_{ij}^2 - \frac{Y_{..}^2}{N} \dots \dots \dots (3.2)$$

$$SSTr = \sum_{i=1}^p y_i^2 - \frac{Y_{..}^2}{N} \dots \dots \dots (3.3)$$

$$SSE = SST - SSTr \dots \dots \dots (3.4)$$

Table 3.1: ANOVA TABLE

Sources of Variation	Degrees of Freedom	Sum of Squares	Mean of Squares	F
Treatment	<i>p - 1</i>	<i>SSTr</i>	$\frac{SSTr}{p-1}$	$\frac{MSTr}{MSE}$
Error	<i>N - p</i>	<i>SSE</i>	$\frac{SSE}{N-p}$	
TOTAL	<i>N - 1</i>	<i>SST</i>		

The hypothesis to be tested is:

H₀: *t_i = 0* (There is no significance difference between the treatment)

Against,

H₁: *t_i ≠ 0* (There is significance difference between the treatments)

Assumptions of one-way ANOVA

- Data must be continuous, that is, different values at different time interval.
- Independent of observations: No relationship between observations in each group i.e. there must be different participants in each group with no participant being in more than one group.
- Dependent variable should be approximately normally distributed for each category of the independent variable.
- Homogeneity of variances.

4.1 DATA ANALYSIS

4.1.1 TREND ANALYSIS

AIM: To fit a trend equation for the rate of inflation in Nigeria for the period of 10years (From January 2011 to December 2020). This analysis is done using the minitab package in order to determine which model will best fit the inflation data for prediction. Both linear trend model and exponential trend model is being carried out to choose the most appropriate.

- The linear trend model is given by the formular;

$$Y = a + bx \dots\dots\dots(4.1)$$

- The exponential trend model is given by;

$$Y = ab^x \dots\dots\dots(4.2)$$

Where Y is dependent variable, X is independent variable, a is intercept, and b is the slope of the above models.

The appropriateness of models that would be chosen depends on the value of Mean Absolute Deviation (MAD). The model with the smallest MAD is chosen to be the appropriate.

The Mean Absolute Deviation of a data set is the average distance between each data point and the mean. It gives us the idea of the variability in the data set in that it shows how far away each data point is from the mean.

Figure 4.1: Linear Trend Model on Inflation Rate in Nigeria from January 2011 to December 2020.

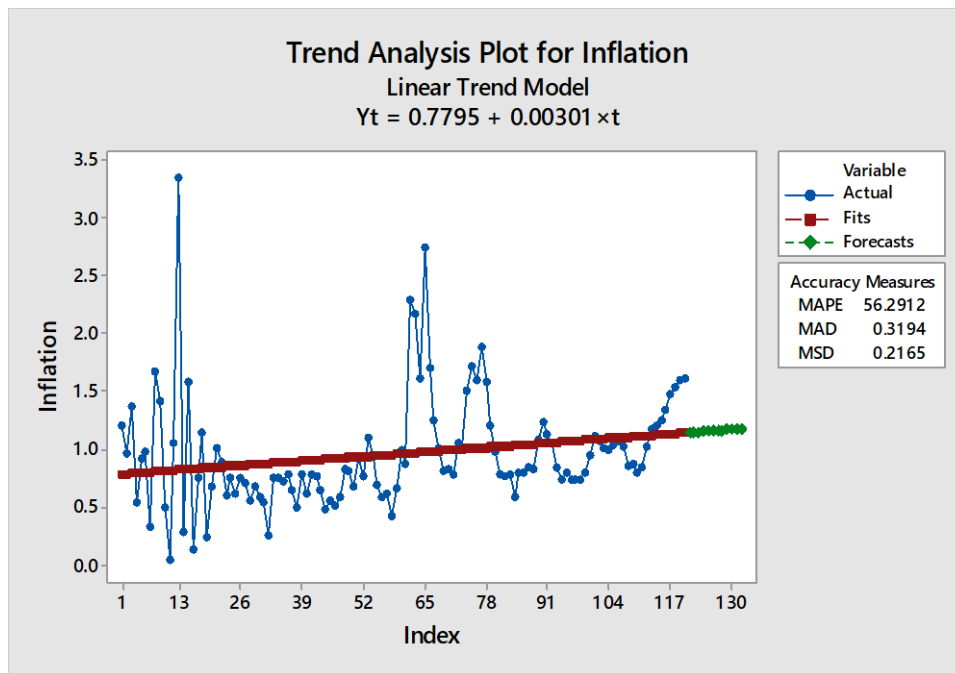


Figure 4.1 showed the Linear trend model of Nigeria inflation in January 2012 has the highest inflation.

Fitted Trend Equation

$$Yt = 0.7795 + 0.00301 \times t \dots\dots\dots(4.3)$$

From the fitted linear trend equation, the constant value is 0.7795 every month and the inflation will be increasing by 0.00301.

Accuracy Measures

MAD = 0.3194

Figure 4.2: Exponential Trend Model on Inflation Rate in Nigeria from January 2011 to December 2020.

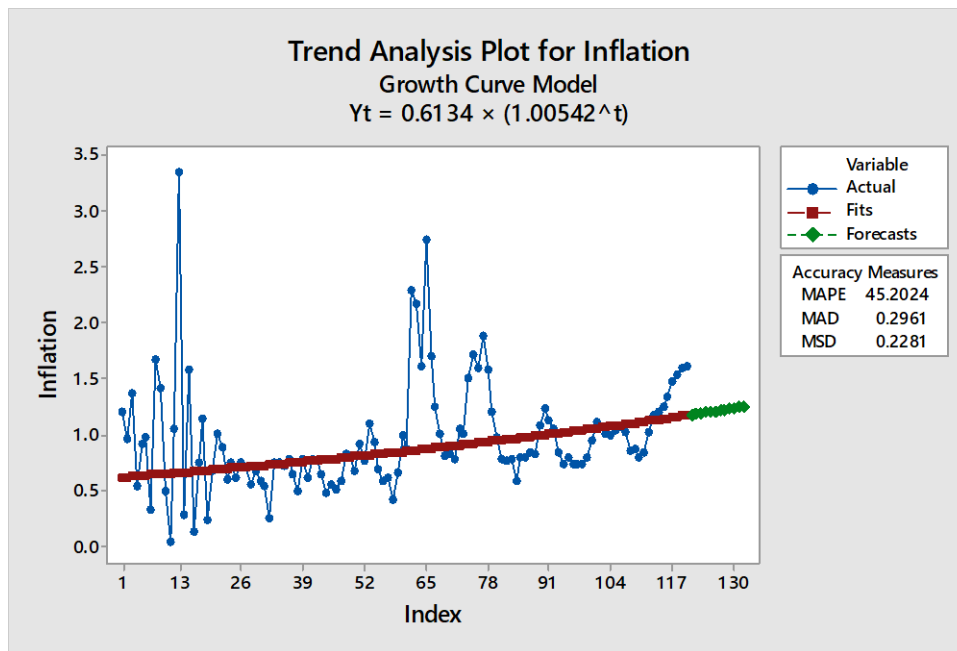


Figure 4.2 showed the Exponential trend model of Nigeria inflation in January 2012 has the highest inflation.

Fitted Trend Equation

$$Y_t = 0.6134 \times (1.00542^t) \dots\dots\dots(4.4)$$

The fitted exponential trend equation, the constant value is 0.6134 every month and the inflation will be increasing by 1.00542.

Accuracy Measures

$$MAD = 0.2961$$

Interpretation of Mean Absolute Deviation

Since the Mean Absolute Deviation of the Exponential trend model = 0.2961 < Mean Absolute Deviation of the Linear trend model which = 0.3194, the best fitted model is the exponential model. Hence it is used to forecast inflation in Nigeria for year 2021 and 2022.

Also, the graph shows that the highest point of inflation rate in Nigeria was in the 13th month, which is January 2012, and the tail end of the curve shows that the country is currently experiencing an increase in inflation.

Table 4.2: Forecasts from January 2021 to December 2022 using the fitted exponential model

Period	Inflation rate Forecast	
	2021	2022
January	1.17922	1.25819
February	1.18560	1.26500
March	1.19203	1.27185
April	1.19848	1.27874
May	1.20497	1.28567
June	1.21150	1.29263
July	1.21806	1.29963
August	1.22466	1.30667
September	1.23129	1.31375
October	1.23796	1.32086
November	1.24467	1.32802
December	1.25141	1.33521

The forecast table 4.2 shows that the rate of inflation in Nigeria will keep increasing. The prediction shows that inflation rate in Nigeria will be 1.33521 by December 2022.

4.2 ONE WAY ANALYSIS OF VARIANCE

AIM: To investigate if there is significant difference between the yearly inflation rate in Nigeria.

Hypothesis:

H₀: There is no significant difference between the yearly inflation rates in Nigeria.

H₁: There is significant difference between the yearly inflation rates in Nigeria

Level of Significance:

$$\alpha = 0.05$$

Test Statistic:

$$F_{tr} = \frac{MSTr}{MSE}$$

Decision criterion

Reject H₀ if P_{value} < 0.05, otherwise do not reject

Table 4.3: One way Analysis of Variance

ANOVA

Inflation

	Sum of Squares	Df	Mean Square	F	Sig.
Between Groups	7.160	9	.796	4.348	.0001
Within Groups	20.125	110	.183		
Total	27.285	119			

Table 4.3 shows that there is significant difference between the yearly Inflation rates in Nigeria. Since $P = 0.0001 < \alpha = 0.05$. Since H₀ is rejected, hence there is a need for a post-hoc test.

Table 4.4 Post Hoc Tests

Homogeneous Subsets

Inflation

Duncan

Years	N	Subset for alpha = 0.05		
		1	2	3
2013	12	.6400		
2014	12	.6408		
2015	12	.7625		
2018	12	.9075	.9075	
2011	12	.9117	.9117	
2019	12	.9467	.9467	
2012	12	.9500	.9500	
2017	12		1.1983	1.1983
2020	12		1.2267	1.2267
2016	12			1.4292
Sig.		.130	.113	.216

Means for groups in homogeneous subsets are displayed.

a. Uses Harmonic Mean Sample Size = 12

The post-hoc test (Duncan) above grouped the years into 3 subsets. The three subsets are statistically significant with p values of 0.130, 0.113, and 0.216 > $\alpha = 0.05$. Hence it is concluded that there is no significant difference in the inflation rate within the grouped years (subsets).

4.2.3 DETERMINATION OF VALUE OF NAIRA

This analysis aimed at highlighting the value of currency, that is, to highlight the effect of inflation on Nigerian currency during the period of study. This can only be achieved by using the Consumer Price Index (CPI) which corresponds to the year of study. Below are the necessary steps needed to calculate the values;

- i) First, we need to calculate the purchasing power using the formula:

$$\text{Purchasing power} = \frac{1}{\text{CPI}} \times 100 \dots\dots\dots(4.5)$$

Table 4.5 below which shows the yearly Consumer Price Index (CPI) is computed from the monthly CPI obtained from the National Bureau of Statistics which can be found in the appendix of this research work.

Table 4.5: Consist of Consumer Price Index (CPI) from 2011 to 2020

Years	CPI
2011	1448.8
2012	1625.8
2013	1763.6
2014	1905.7
2015	2077.6
2016	2403.6
2017	2800.1
2018	3139
2019	3496.7
2020	3959.8

This involves using EXCEL spread sheet to compute the yearly values of the purchasing power of Naira by inserting the formula;

$$\text{Purchasing Power} = \frac{1}{\text{CPI}} \times 100 \dots\dots\dots(4.6)$$

Table 4.6 EXCEL Analysis Output

Year	CPI	Purchasing Power
2011	1448.8	0.0690
2012	1625.8	0.0615
2013	1763.6	0.0567
2014	1905.7	0.0525
2015	2077.6	0.0481
2016	2403.6	0.0416
2017	2800.1	0.0357
2018	3139.0	0.0319
2019	3496.7	0.0286
2020	3959.8	0.0253

Table 4.6 shows that the purchasing power of naira from year 2011 keeps decreasing till 2020. This means that the quantity of goods and services that Nigeria currency could buy in year 2020 is small compared to the goods and services it was buying in year 2011. Hence, the rate of inflation in Nigeria has effect on the economy of the country.

5.0 SUMMARY, CONCLUSION AND RECOMMENDATION

5.1 SUMMARY

The research work was designed to analyse the effect of inflation rate on Nigerian economy. The statistical tools used for the analysis were; Time Series Analysis, particularly the trend analysis and One-way Analysis Variance which were fully discussed for easy understanding of the analysis. Also, the purchasing power of Naira was determined to check the effects of inflation on the economy.

5.2 CONCLUSION

Based on the analysis carried out, from the time series analysis, two model was fitted; the linear trend model and the exponential trend model. The

exponential trend model was the best fit because it has small Mean Absolute Deviation of 0.2961, compared to the linear model with Mean Absolute Deviation of 0.3194. Hence, the exponential model was used to forecast the inflation rate of Nigeria for the period of 2 years, which reveals that the inflation rate will keep increasing.

The one-way Analysis of Variance revealed that there is significant difference between the yearly inflation rates in Nigeria. A post-hoc Duncan test was further carried out and it showed the harmonic means and grouped the years into three subsets. There was no significant difference for the rate of inflation for the years within each subset, but there was significant difference between the three subsets.

The value of naira was determined by computing the purchasing power of naira, and the result shows that the purchasing power of naira from year 2011 keeps decreasing till 2020. This means the quantity of goods and services Naira can buy presently is small compared to year 2011, hence making the economy to be harsh.

5.3 RECOMMENDATION

Since the trend analysis forecast has revealed that there will be increase in inflation, government should create policies and programmes that will help control inflation in the country. Fiscal policy like reduction of value added tax (VAT) by government should be done to reduce the increase in price of goods and services. Income tax should also be reduced to cut down poverty.

Government should work on improving the security of this country. The cases of kidnapping and banditry has so increased that farmers are afraid of going to farm for fear of being killed, which has made food production to decrease drastically thereby increasing the cost of food items. Providing good security will increase farm production and reduce cost.

Finally, since the purchasing power of Naira has dropped, government should look into the factors causing it. Monetary policy should be followed to control the flow of money in the economy. Government should also pay up National debt to improve the value of the currency of Nigeria.

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