FITTING ARIMA MODEL ON MONTHLY AVERAGE EXCHANGE RATE OF GREAT BRITAIN POUNDS TO NIGERIA CURRENCY (N)

(A CASE STUDY OF WESTERN UNION)

BY

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CERTIFICATION

This is to certify that this project was carried out by AYUBA BAKARE with Matriculation Number HND/23/STA/FT/0025. The project has been read and approved as meeting part of the requirement for the award of Higher National Diploma in Statistics.

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DEDICATION

This project is dedicated to Almighty **ALLAH,** The creator of the universe. All Glory and Adoration belong to him, who is, who was and who shall always be. Also, to all the people in the world who are practicing farm agriculture as a field of study.

ACKOWLEDGEMENT

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My gratitude goes to my beloved parents Mr and Mrs BAKARE, I can't thank you enough for your parental advice and financial support since the beginning of this program, JAZAAAKUMLLAH KHAYR. I pray Allah (SWT) spare their lives and make them reap the fruit of their labour.

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ABSTRACT

The research work is based on fitting of Arima model on monthly average exchange rate of GB POUNDS to Nigeria Currency from 2010 to 2020. During the course of the study, the statistical analysis used is Time series analysis using Arima 111 to fit the model. From the result obtained, the time series plot shows that the data is not stationary, and from the result obtained in the analysis, : The ACF (autocorrelation function) of the differenced series of life expectancy shows a positive auto correlation at lag1 which decrease to zero, this suggests AR [1], also The PACF (partial autocorrelation function) shows a gradual attenuation from its initial value which also suggested MA [1].since we have differenced of our original data to be one [1] to obtain AR [1] and MA [1] patterns, our ARIMA identification includes one degree of auto regressive, one degree of differencing and one degree of moving average in conventionally ARIMA notation, we have tentatively identified an ARIMA [1, 1, 1]. Also The acf and pacf are presented for the residuals and it could be seen clearly that the model is reasonable because the plotted residuals look like white noise {Independent zero mean random variables}, which means that the acf and pacf are theoretically 0 at all non-Zero lags. This indicates that the residuals do not have significant lagged acf and pacf so that is good for the model. And the (Model parameter block) shows which AR and MA terms were fit, And lastly the forecast future values for the next 5 years, indicate that there is Increase in trend across the various years.

Keywords: *ARIMA (1,1,1), GB POUNDS, ACF and PACF*

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CHAPTER ONE

1.0 INTRODUCTION

Exchange rate is a major variable in the general economic policy making both in developed and developing economies as its appreciation or depreciation affects the performance of other macroeconomic variable and it's attainment of macroeconomic objective cannot be over emphasized. A very strong exchange rate is a reflection of a strong and viable economy while on the other hand; a very weak exchange rate is a reflection of a very weak and vulnerable economy. In the light of its importance, every country pays so much attention to the appropriateness of her foreign exchange policy. As a result, governments, especially in the developing economies over the years have adopted different exchange rate management policies with a view to achieve realistic and stable exchange rate. Thus, most of these countries including Nigeria experienced high exchange rate fluctuation which translates into high degree of uncertainty (Ajao and Igbokoyi, 2013).

Nigerian pound in sympathy with the British pound. Two major reasons accounted for this reluctance. First, a considerable share of the country's resources was being diverted to finance the war. And second, there was the apprehension that devaluation of the Nigerian pound would only raise domestic prices of imports without any appreciable impact on exports, which were still largely primary products. Rather than devalue the Nigerian pound, the monetary authorities decided to quote the Nigerian currency in reference to the US dollar. In addition, they impose severe restrictions on imports as well as strict administrative controls on foreign exchange.

The determination of appropriate and sustainable exchange rate in Nigeria has not been an easy task to both the government and policy makers. Before the introduction of the Structural Adjustment Programme (SAP) in 1986, Nigerian currency was said to be overvalued and that was why it was opened to market forces of demand and supply in

1986 to determine its real value. Since the devaluation that followed till date, the Nigeria's exchange rate policies have not yet been appropriate or able to accomplish the desired objectives. It would be recalled that after experimenting with flexible exchange rate policies since 1986 through Second-tier foreign exchange market (SFEM), Dutch Auction System (DAS), Modified Dutch Auction System (MDAS), Weighted Dutch Auction System (WDAS), etc., and punctuated by fixed exchange rate (1994-1998), the monetary authorities found it necessary to revert to fixed exchange rate policy in 2008. It soon neglected that and opted for currency redenomination which was rejected. There was the re-introduction of the DAS in 2002 as a result of the intensification of the demand pressure in the foreign exchange market and the persistence in the depletion of the country's external reserves. Also, there was the introduction of the wholesale DAS in 2006 which further liberalized the market in an attempt to evolve a realistic exchange rate of the Naira, and finally the managed float exchange rate system which was introduced in June, 2016. The evolution of the foreign exchange market in Nigeria up to its present state was influenced by a number of factors such as the changing pattern of international trade, institutional changes in the economy and structural shifts in production.

The behavior of the naira exchange rate under each system was markedly different volatile in some and fairly stable (but unrealistic) in others. Management of the exchange rate in Nigeria. The concern with exchange rate management policy in Nigeria can be traced back to 1960 when the country became politically independent, even though the Central Bank of Nigeria and the Federal Ministry of Finance had come into being two years earlier. There are a variety of ways and reasons for classifying subsequent developments in Nigeria's exchange rate policy. One classification would put such developments into two phases, namely, a passive phase and an active phase. Yet another binary classification, which is essentially equivalent to the foregoing, is the pre-structural adjustment and post structural adjustment division in exchange rate policy developments. A classification that seems

1.1 AIM AND OBJECTIVES:

The aim of the research is to study the rate of exchange of GB pounds currency, using Time series analysis, while the Objectives are to:

- Obtain the time series plot of the monthly GB pounds currency data
- To test for the stationarity of the data
- To fit the appropriate model for the series
- To forecast for future values of the rate of exchange in GB pounds over the next five years

1.2 SIGNIFICANCE OF THE STUDY

Monetary foreign exchange is said to be an important element in the economic growth and development of a developing nation because the policies influence the economic activities and to a large extent, dictate the direction of the macro-economic variables in the country.

1.3 SCOPE OF STUDY

The research work which study the roofing sheet quality the life span cover some selected and common roofing sheets commonly used in the roofing during construction of shelters.

1.4 LIMITATION OF STUDY

In the course of the research work some constructions were encounter such as access to data identification of roofing sheet types, the data used is a published data from the source of Central Bank of Nigeria (CBN), which is limited from 2010-2020

CHAPTER TWO

2.0 LITERATURE REVEIW

The behavior of the naira exchange rate under each system was markedly different volatile in some and fairly stable (but unrealistic) in others. Management of the exchange rate in Nigeria. The concern with exchange rate management policy in Nigeria can be traced back to 1960 when the country became politically independent, even though the Central Bank of Nigeria and the Federal Ministry of Finance had come into being two years earlier.

According to Amartya Sen.(1999)" There are a variety of ways and reasons for classifying subsequent developments in Nigeria's exchange rate policy. One classification would put such developments into two phases, namely, a passive phase and an active phase. Yet another binary classification, which is essentially equivalent to the foregoing, is the pre-structural adjustment and post structural adjustment division in exchange rate policy developments. A classification that seems to capture the historical sequence more closely, however, would divide exchange rate management into five periods or stages. Stage I: Fixed parity between the Nigerian pound and the British pound In the first period of exchange rate policy in Nigeria, which spanned the year 1960-1967 there was a one-to-one relationship between the Nigerian pound (Ne) and the British pound sterling (Se). This fixed parity lasted until the British pound was devalued in 1967. Because of the Nigerian civil war which was going on at the time, the monetary authorities did not consider it expedient to devalue the Nigerian pound in sympathy with the British pound. Two major reasons accounted for this reluctance.

Ahmad .G. (2000) reported that, a considerable share of the country's resources was being diverted to finance the war. And second, there was the apprehension that devaluation of the Nigerian pound would only raise domestic prices of imports without any appreciable impact on exports, which were still largely primary products. Rather than devalue the Nigerian pound, the monetary authorities decided to quote the Nigerian currency in reference to the US dollar. In addition, they impose severe restrictions on imports as well as strict administrative controls on foreign exchange. Stage II: Fixed parity between the Nigerian pound and the American dollar the second period of Nigeria's exchange rate policy lasted from 1967 to 1974.

Akogun, B. (2003). analyzed the determinants of the nominal exchange rate in Croatia by using the bounds testing (ARDL) approach to co-integration. The results indicated the existence of a stable co-integration relationship between the observed macroeconomic variables and the nominal exchange rate, whereby an increase in the majority of the variables led to an exchange rate appreciation. Thus, the determination of the nominal exchange rate in Croatia primarily depends on the external factors that affect domestic economy. It was however recommended that the results obtained can be useful to policy makers in making monetary policy decisions in keeping the exchange rate stable.The variables used in the study include; government expenditure, money supply, domestic debt and external debt. The study employed the ARDL model to examine the relationship between the variables. The findings revealed that there exist positive relationship between government expenditure and exchange rate volatility.

Emiray and Rodriguez (2003) applied various time series models including a linear model withstable deterministic seasonality, a linear model with seasonal unit roots, seasonal autoregressive integrated moving average (SARIMA) model, periodic AR model, and structural time series model. They used Canadian air passengers' monthly data and concluded that the simple models perform better in the short-term, while flexible and adoptable complex models work better in the long-term. Also, the original country of the passengers, the flight type (domestic, trans-border, and international), the performance measure, and the forecasting horizon influence the forecasting performance of the models.

Morzuch(2004) investigated the models proposed by Chan and Chu (2014) along with two of their own, to forecast the inbound tourist arrivals to Singapore. They worked on within sample performance of the competing models and also the post-sample performance. They foundthat the winter's three-parameter model outperforms the ARIMA model based on the within-sample results, and the ARIMA model outperforms the Winters three-parameter model based on post-sampleresults.

Chu (1999) incorporated the fractionally integrated autoregressive moving average (ARFIMA) models into Singapore's tourism forecasting and compared the accuracy of forecasts with previous studies.

The Purchasing Power Parity (PPP) approach to the exchange rate determination was and continues to be a very influential way of thinking about the exchange rate. The PPP posits that the exchange rate between two currencies would be equal to the relative national level prices. The PPP derives from the assumption that in the world there exists the law of one price. This law states that identical goods should be sold at identical prices. The law of one price implies that exchange rate should adjust to compensate for price differentials across countries (Hoontrakul, 1999). Notwithstanding, the infraction to this law often engendered by transportation and handling charges, it is generally believed that the law is plausible. Accordingly, the absolute PPP stipulates that the absolute level of the exchange rate is that which causes traded goods and services to have same price in all countries when measured in the same currency. There is however very little empirical support for the absolute PPP due to the rather strong influence of transportation costs and trade barriers at keeping prices from equalizing across geographical locations, and the effect of the differences in the composition and relative importance of various goods on each country's price level determination (Bell, W.R 2012). The Portfolio Balance approach views the exchange rate as resulting from a process of financial equilibrium in the economy. Such financial equilibrium results from a simultaneous equilibrium in the individual financial asset markets, that is, when the amount of each asset desired to be held is the amount that is actually held. Three of such markets are considered very important here, domestic money or monetary base, domestic bonds and foreign bonds. Three equilibrium prices emerge from the attainment of this financial equilibrium:

equilibrium price of each asset, the equilibrium interest rate in the country and the equilibrium exchange rate. The exchange rate emerges from this model because any portfolio switches between the domestic assets and the foreign asset necessitates new demand for foreign exchange noted that the approach disregards the fundamentals of trade in its calculations and this may be a source of inexplicable changes in the exchange rate.

CHAPTER THREE

3.0 RESEARCH METHODOLOGY

3.1 INTRODUCTION

Data collection is the process of gathering information for the purpose of investigation or inquires. Most often the information we need for such investigation are not readily available either because they are not documented or are scattered in various documents. Data collection is a very important stage in every statistical investigation, in fact, the method employed in the collection of data determines to a large extend the source of the enquiry. There are two sources of data collection we have primary and secondary sources and also two types of data which are primary and secondary data. The type of data are used in this research is the secondary data.

Data is said to be obtained from primary source if it represents the raw material of an investigation. Such data are the most original and authentic data that is not obtained from primary source are said to be obtained from secondary source, they are not original or material which has undergone some sort of statistical treatment, at least once for a certain purpose. Data collected from primary and secondary sources are referred to as primary and secondary data respectively. But based on this research, the data used is obtained from a secondary source published by Central Bank of Nigeria (CBN) on GB pounds from 2010 to 2020

3.2 METHODS OF DATA COLLECTION

There are many techniques or methods of data collection. The most important among these are discussed as follows:

- **Interview method:** By this method, data are collected from the informants by trained agents called enumerators. These agents visit the informants in their houses or offices, in the markets or on the streets as the case may be, asked the necessary questions and enter the replies in special blank called schedule. This method has some advantage and disadvantages as follows:

Advantages

- It is easy to conduct
- It gives no room for malpractice
- It is good for planning purposes

Disadvantages

- Very expensive
- Possibility of missing people in their houses is high

- **Questionnaire method:** By the questionnaire method, a list of questions which seeks response to a number of pertinent questions of interest to the investigator. The importance of a good questionnaire cannot be over-emphasized. There are two types of questionnaires which are structural (close-ended) and the unstructured (open-ended) questionnaire.

Advantages

- It is easy to conduct
- It gives no room for malpractice

Disadvantages

- Very expensive
- The right answer may not be not given

- **Registration Method:** This is a method whereby data are collected by keeping records of events. Immediately they occur or soon after their occurrence. By this method, information is collected through registration of births, deaths, marriages, divorces, immigration and emigration, motor accidents, industrial accidents and many more. It is more efficient in developed countries than in the developing once. This method provides valuable record of social charges over time.

❖ **Documentary Method:** The use of documentary sources is very important in the planning stage of collecting data from any of the source primary or secondary. It is of no useful hurrying into field without consulting any official or private.

3.3 METHOD OF DATA ANALYSIS

In this research, the statistical analysis used is Time series Arima Model to analyze the record of Monthly sales of GB pounds data (2010-2020).

. The methodology used is Time Series Arima Model (1,1,1).

There are series of methods that can be used to model time series data which includes;

- Autoregressive Model (AR)
- Moving Average (MA)
- Autoregressive Moving Average Model (ARMA)
- Autoregressive Integrated Moving Average Model (AIMAM)
- Seasonal Autoregressive Integrated Moving Average Model (SARIMA)
- Autoregressive Fractional Integrated Moving Average Model (AFRIMA)

3.4 AUTOREGRESSIVE MODEL [CAP (P)]

An AR model with order (P) parameter is written as:

$x_t = a_1 x_{t+1} + a_2 x_{t+2} + \ldots\ldots + a_p x_{t+p} + \varepsilon_t$

Where x_t = time series under investigation

a = the autoregressive parameter

a_p = the autoregressive parameter order p

x_{t-1} = the series at lagged period

ε_t = the error term of the model

This simply means any given value x_t can be explained by some function of its previous value. x_t, plus some unexplained random error, ε_t.

3.5 MOVING AVERAGE [MA (q)]

A second type of box Jenkins model is called a moving average model. Although those models look very similar to the AR model, the concept behind them is quite different. Moving average parameter (q) relates what happens in period (t) only to the random errors that occurred in the time passed period i.e ε_{t-1}, ε_{t-2}, etc, rather than to x_{t-1}, x_{t-2}, x_{t-2}. As an autoregressive model (AR) approaches.

A moving average model with order (q) is written as;

$x_t = \beta i_{(t-1)} + \ldots\ldots + \beta_q \varepsilon_{t-q} + \varepsilon_t$

Where x_t = time series under investigation

β_i = the moving average parameter

β_q = the error term in the model

The negative sign in front of the parameter is used conventionally and is usually printed out automatically by most of the computer programs.

The model simply means that any given values of xt is directly relate on to the random error in the previous period, ε(t-1) and to the current error term.

3.6 AUTOREGRESSIVE MOVING AVERAGE [ARIMA (p,d,q)]

This model is also called "mixed model" because it incorporate both Autoregressive (AR) and Moving Average (MA) model, for ARMA of order (p,q) is as follows;

$x_t = a_1 x_{t-1} + \ldots + a_p x_{t-p}$.........order 1

$x_t = a_1 x_{t-1} + a_2 x_{t-2} + \ldots + \varepsilon_t$.................. order 2

Where

p= the number of the autoregressive part

q= the order of the autoregressive model.

3.7 AUTOREGRESSIVE INTEGRATED MOVING AVERAGE (p,d,q)

This is the generalization of an autoregressive moving averages model (ARMA) to include the case of non-stationary as well. In ARIMA models a non-stationary time series is made stationary by applying finite differencing of the data points. These models are filled in order to understand or to product future points. ARIMA model is generally denoted as ARIMA (p,d,q) are non-negative integers.

- Here p, d and q are integers greater than zero or equal to zero and refer to the order of autoregressive, integrated and moving average parts of the model respectively.
- The integer'd' controls the level of differencing. Generally d=1 d=0 it reduces to an ARIMA (p,q) model
- An ARIMA (p,0,0) is nothing but the AR(p) model and ARIMA (0,0,0) is the MA(q) mode
- ARIMA (1, 0, 0) is a special one and widely used for stationary data.

P= order of autoregressive

D=degree of differencing

Q= order of moving average model

ARIMA model can be defined as:-

$x_t^d = a_i x_{t-1}^d + a_p x_{t-p} + \beta_i \varepsilon_{t-1} + \beta_p \varepsilon_{t-q}$

Where x_t^d is 1time series

3.8 SEASONAL AUTOREGRESSIVE INTEGRATED MOVING AVERAGE (SARIMA {P,OQ,M}

The second pest of the model consist of terms that are very similar to non-seasonal components of the model .but they involves back shifts of the seasonal period.

The model is as follows:

$$(1-\o_i\beta) \quad (1-\o_i\beta^m) \quad (1-\beta \quad) \quad (1-\beta^m)y_t$$

$$\begin{bmatrix} Non-seasonal \\ AR\ (p) \end{bmatrix} \begin{bmatrix} seasonal \\ AR\ (p) \end{bmatrix} \begin{bmatrix} Non-seasonal \\ difference \end{bmatrix} \begin{bmatrix} seasonal \\ difference \end{bmatrix}$$

$$= \quad (1-\o_i\beta) \quad (1-\o_i\beta)\varepsilon_t$$

$$\begin{bmatrix} Non-seasonal \\ differenceMA(q) \end{bmatrix} \begin{bmatrix} seasonal \\ MA\ (q) \end{bmatrix}$$

A seasonal ARIMA model is formed by including addition season terms in to the ARIMA model i.e.

(P,dq) (P,D,Q)m

(Non-seasonal part of the model) (Seasonal part of the model)

p = non seasonal AR order P= Seasonal AR order

d= non seasonal differencing D= seasonal differencing

q= non seasonal MA order M= number of periods per season/ Season pattern

Without differencing operations, the model can be written as;

$ø\beta^m\, ø\beta(x_{t-\mu}) = 1 - ø\beta^m\, ø\beta^{wt}$

The non-seasonal components will be

AR: $ø(\beta) = 1 + ø_i\beta + ø_p\beta^p$

MA; $ø(\beta) = 1 + ø_i\beta + \ldots + ø_p\beta^p$

The seasonal components will be:

Seasonal AR $ø\beta^m -= -\ldots.\ ø_p\beta^{pm}$

Seasonal MA: $ø\beta^m = 1 + ø_i\beta^m + \ldots. + ø_p\beta^{qm}$

3.9 AUTOREGRESSIVE FRACTONALLY MOVING AVERAGE (ARIFMA)

This is the fractional part of ARIMA modeling (P,d). All the parameters, autoregressive moving average and differencing can be simultaneously estimated in below:

$ø(\beta)\varepsilon_t = ø\beta\ (1 - \beta^d)x^t$

Where d = differencing parameter

ε_t = white noise process known as error with $\varepsilon(\varepsilon_t)$

3.10 AKAIKE INFORMATION CRITERION

AIC= $MLL_i - d_i$

Where mill =lin (ML_i) is the maximum log likelihood over its method

d_i = the dimension (differencing) of the model

3.11 BAYESAIN INFROMATION CRITERION

By extending such war's (1978) basic idea, we derive a Bayesian information criterion which enables us to evaluate method estimated by their maximum paralyzed likelihood method or the method or regulation.

BIC= $MLL_i - \frac{1}{2} d_i \log(n)$

Where MLL_i =lin (MLi) is maximum log likelihood over its method 1^{th} model.

d_i =the differencing of the i^{th} model

CHAPTER FOUR

4.0 DATA PRESENTATION AND ANALYSIS

This chapter presents the data and the statistical techniques used to analyze the data is Time series analysis.

4.1 DATA PRESENTATION

MONTHS/YEARS	GB POUNDS
JAN 2012	239.96
FEB 2012	232.66
MAR 2012	223.26
APR 2012	217.36
MAY 2012	219.42
JUN 2012	219.42
JUL 2012	227.02
AUG 2012	232.94
SEP 2012	232.86
OCT 2012	237.62
NOV 2012	232.78
DEC 2012	236.92
JAN 2013	242.81
FEB 2013	243.95
MAR 2013	249.16
APR 2013	250.11
MAY 2013	248.14
JUN 2013	242.51
JUL 2013	247.53
AUG 2013	224.48
SEP 2013	239.15
OCT 2013	243.27
NOV 2013	246.98
DEC 2013	246.92
JAN 2014	249.34
FEB 2014	248.03
MAR 2014	242.42
APR 2014	243.66
MAY 2014	244.87
JUN 2014	250.86
JUL 2014	250.45
AUG 2014	248.69
SEP 2014	251.56
OCT 2014	248.72
NOV 2014	241.10

DEC 2014	234.75
JAN 2015	238.34
FEB 2015	241.11
MAR 2015	235.64
APR 2015	241.35
MAY 2015	251.43
JUN 2015	250.86
JUL 2015	250.76
AUG 2015	255.13
SEP 2015	256.59
OCT 2015	257.81
NOV 2015	258.95
DEC 2015	260.67
JAN 2016	262.41
FEB 2016	263.29
MAR 2016	265.93
APR 2016	260.12
MAY 2016	254.06
JUN 2016	250.27
JUL 2016	249.96
AUG 2016	262.86
SEP 2016	254.39
OCT 2016	274.79
NOV 2016	295.60
DEC 2016	294.24
JAN 2017	304.79
FEB 2017	306.06
MAR 2017	306.41
APR 2017	307.21
MAY 2017	302.55
JUN 2017	302.26
JUL 2017	299.38
AUG 2017	295.39
SEP 2017	283.62
OCT 2017	281.79
NOV 2017	280.40
DEC 2017	282.07
JAN 2018	286.33
FEB 2018	328.53
MAR 2018	388.37
APR 2018	406.13
MAY 2018	401.08
JUN 2018	375.71
JUL 2018	379.49
AUG 2018	381.39
SEP 2018	376.32
OCT 2018	381.17

NOV 2018	378.13
DEC 2018	386.92
JAN 2019	395.04
FEB 2019	391.57
MAR 2019	397.36
APR 2019	396.08
MAY 2019	408.57
JUN 2019	403.25
JUL 2019	404.45
AUG 2019	410.48
SEP 2019	422.35
OCT 2019	427.40
NOV 2019	427.26
DEC 2019	428.38
JAN 2020	412.23
FEB 2020	406.64
MAR 2020	402.76
APR 2020	394.24
MAY 2020	399.86
JUN 2020	395.87
JUL 2020	389.40
AUG 2020	395.53
SEP 2020	399.02
OCT 2020	404.28
NOV 2020	400.18
DEC 2020	393.98
JAN 2021	388.93
FEB 2021	382.80
MAR 2021	373.26
APR 2021	376.06
MAY 2021	388.43
JUN 2021	395.63
JUL 2021	402.83
AUG 2021	401.22
SEP 2021	397.96
OCT 2021	403.79
NOV 2021	447.92
DEC 2021	443.96
JAN 2022	452.17
FEB 2022	476.54
MAR 2022	500.38
APR 2022	494.18
MAY 2022	494.71
JUN 2022	503.49
JUL 2022	511.67
AUG 2022	397.96
SEP 2022	403.79

OCT 2022	447.92
NOV 2022	443.96
DEC 2022	452.17

Source: Central Bank of Nigeria/westernunion.com

4.2 DATA ANALYSIS

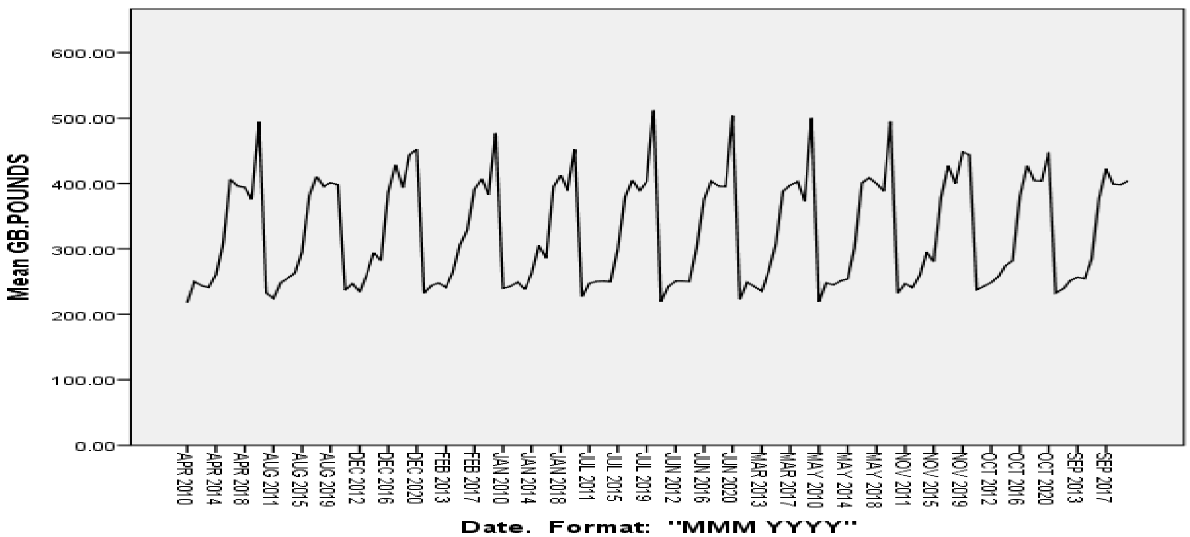

Fig 1

Comment: Fig 1 showing the plot line chart of the original data, it could be seen clearly that there is fluctuation of lines which determine the stationary of the data .

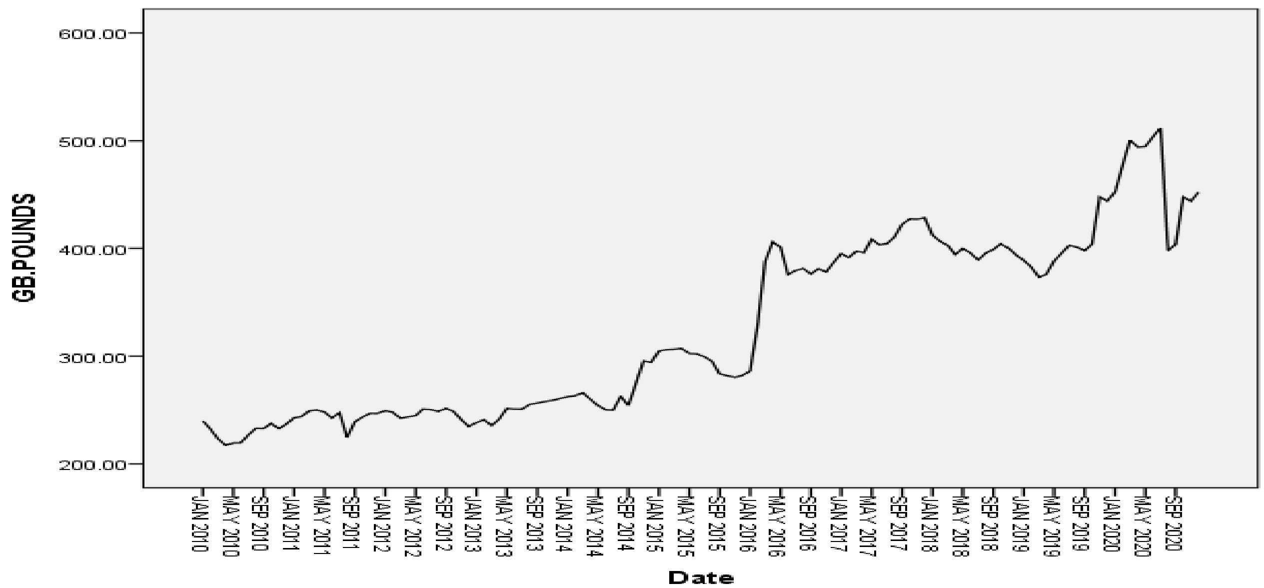

Fig 2

Comment: Fig 2 showing the time series plot of the original data

Table 4.1

Model Description

	Model Type
Model ID GB.POUNDS Model_1	ARIMA(1,1,1)(0,0,0)

Table 4.2

Model Fit

Fit Statistic	Mean	SE	Minimum	Maximum	Percentile 5	10	25	50	75	90	95
Stationary R-squared	.036	.	.036	.036	.036	.036	.036	.036	.036	.036	.036
R-squared	.969	.	.969	.969	.969	.969	.969	.969	.969	.969	.969
RMSE	14.845	.	14.845	14.845	14.845	14.845	14.845	14.845	14.845	14.845	14.845
MAPE	2.297	.	2.297	2.297	2.297	2.297	2.297	2.297	2.297	2.297	2.297

MaxAPE	29.259	.	29.259	29.259	29.259	29.259	29.259	29.259	29.259	29.259	29.259
MAE	7.723	.	7.723	7.723	7.723	7.723	7.723	7.723	7.723	7.723	7.723
MaxAE	116.440	.	116.440	116.440	116.440	116.440	116.440	116.440	116.440	116.440	116.440
Normalized BIC	5.507	.	5.507	5.507	5.507	5.507	5.507	5.507	5.507	5.507	5.507

Comment: Table 4.2 shows the descriptive statistics such as mean, minimum and maximum values of the Stationary values, Normalized BIC of the original Data. for Stationary R-squared, this is a measure that compares the stationary part of the model to a simple mean model and since the stationary R-square value is positive (0.036), it simply means that the model under consideration is better than the baseline model, also for R-square measure the goodness of fit of a linear model, it is sometimes called the coefficient of determination, and since it has a value very close to 1 which is 0.969 indicates the model fit the data well, and for RMSE (Root mean square error) which measure of how much a dependent series varies from its model-predictive level, also for MAPE(Mean Absolute Percentage Error) which measure of how much a dependent series varies from its model-predicted level and can be used to compare series with different units, and lastly for Normalized BIC (Normalized Bayesian Information Criterion) with the value of 5.507 shows the correct general measure of the overall fit of a model attempts to account for model complexity.

Table 4.3

Autocorrelations

Series: GB POUNDS

Lag	Autocorrelation	Std. Error[a]	Box-Ljung Statistic		
			Value	Df	Sig.[b]
1	.836	.154	29.438	1	.000
2	.748	.152	53.635	2	.000
3	.712	.150	76.169	3	.000

4	.629	.148	94.235	4	.000
5	.565	.146	109.250	5	.000
6	.460	.144	119.509	6	.000
7	.390	.141	127.103	7	.000
8	.340	.139	133.059	8	.000
9	.261	.137	136.689	9	.000
10	.142	.135	137.797	10	.000
11	.057	.132	137.985	11	.000
12	.036	.130	138.062	12	.000
13	.019	.128	138.083	13	.000
14	-.051	.125	138.248	14	.000
15	-.077	.123	138.645	15	.000
16	-.076	.120	139.041	16	.000

a. The underlying process assumed is independence (white noise).

b. Based on the asymptotic chi-square approximation.

Comment: From the table 4.3 above, which shows the correlation between points separated by various time lags together with their various std error and as well as their significant values, which could be seen clearly that Lag 1 has the lowest value of 29.438

Table 4.4

Partial Autocorrelations

Series: GB POUNDS

Lag	Partial Autocorrelation	Std. Error
1	.836	.160
2	.162	.160
3	.179	.160

4	-.095	.160
5	.004	.160
6	-.203	.160
7	.015	.160
8	.000	.160
9	-.047	.160
10	-.242	.160
11	-.050	.160
12	.124	.160
13	.149	.160
14	-.122	.160
15	.046	.160
16	.012	.160

Comment: table 4.4 shows the partial auto correlation function of the series as well, which could be seen clearly the Partial correlation point at Lag 1 has the highest value.

Table 4.5

ARIMA Model Parameters

					Estimate	SE	t	Sig.
GB POUNDS-Model_1	GB POUNDS	No Transformation	Constant		.136	.027	5.103	.000
			AR	Lag 1	.458	.206	2.223	.033

	Difference		1			
	MA	Lag 1	.992	1.401	.708	.484

Comment: From table 4.5 (Model parameter block) shows which AR and MA terms were fit, the estimate values of their coefficients, the standard error of the estimate, the t-test statistic for the significance test and the p-values that test for the null hypothesis, which shows that Arima (1,1,1) is suitable for the data.Hence the prediction equation can be written as:

$$X_t = 0.136 + 0.458X + 0.992_{\varepsilon t-1}$$

Table 4.6

H_0: The Model is best fitted and suitable for the data

H_1: The Model is not fitted and suitable for the data

Model Statistics

Model	Number of Predictors	Model Fit statistics				Ljung-Box Q(18)		Number of Outliers
		Stationary R-squared	R-squared	RMSE	MAPE	Statistics	DF	Sig.
GB.POUNDS-Model_1	0	.036	.969	14.845	2.297	12.310	16	.722

Comment: The model statistics table 4.6 above described how best the model is, because the smallest the value of the stationary R-squared (0.036) the better the model. And also since the sig.value (0.722) > 0.05, therefore we hereby do not reject the null hypothesis and conclude that the model is best fitted and suitable for the data.

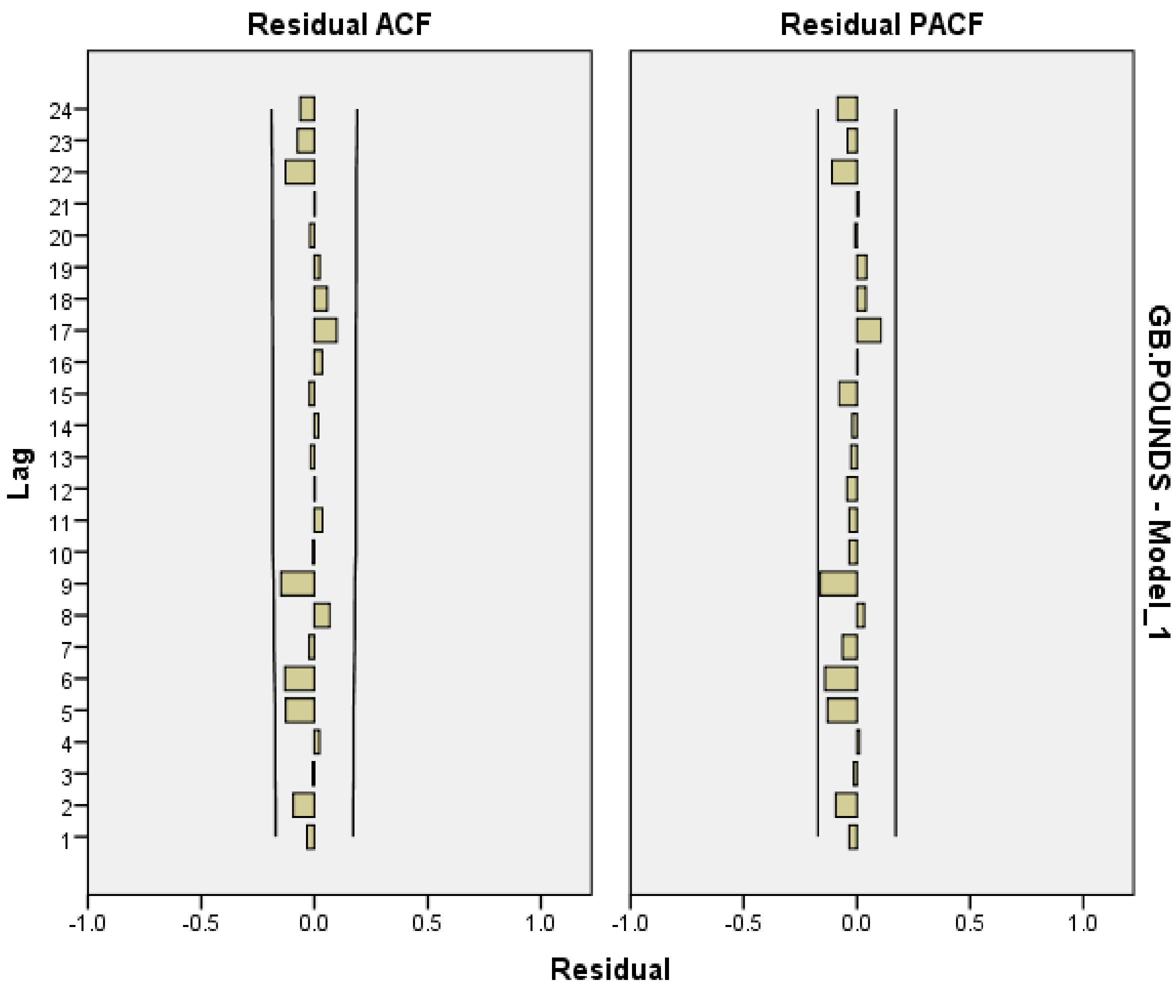

Fig 2

Comments: The acf and pacf in fig 2 above are presented for the residuals and it could be seen clearly that the model is reasonable because the plotted residuals look like white noise {Independent zero mean random variables}, which means that the acf and pacf are theoretically 0 at all non-Zero lags. This indicates that the residuals do not have significant lagged acf and pacf so that is good for the model.

Table 4.6 FORECASTS FOR 5 YEARS

MONTHS/YEARS	FORECAST VALUES	LCL FOR FORECAST VALUES	UCL FOR FORECAST VALUES
JAN 2023	459.39	430.73	488.05
FEB 2023	463.74	423.19	504.29
MAR 2023	469.45	419.77	519.14
APR 2023	469.51	412.11	526.91
MAY 2023	471.85	407.65	536.05
JUN 2023	469.67	399.31	540.04
JUL 2023	471.66	395.63	547.70
AUG 2023	461.86	380.54	543.18
SEP 2023	462.83	376.54	549.12
OCT 2023	471.01	380.01	562.01
NOV 2023	474.99	379.51	570.48
DEC 2023	475.61	375.83	575.39
JAN 2024	482.83	378.93	586.73
FEB 2024	487.18	379.31	595.05
MAR 2024	492.90	381.19	604.60
APR 2024	492.95	377.53	608.37
MAY 2024	495.29	376.26	614.32
JUN 2024	493.11	370.58	615.65
JUL 2024	495.10	369.15	621.05
AUG 2024	485.30	356.02	614.58
SEP 2024	486.27	353.74	618.80
OCT 2024	494.45	358.74	630.17
NOV 2024	498.43	359.61	637.26
DEC 2024	499.05	357.17	640.93
JAN 2025	506.27	361.40	651.13
FEB 2025	510.62	362.82	658.43

MAR 2025	516.34	365.65	667.02
APR 2025	516.39	362.87	669.91
MAY 2025	518.73	362.42	675.04
JUN 2025	516.55	357.50	675.61
JUL 2025	518.54	356.79	680.30
AUG 2025	508.74	344.33	673.16
SEP 2025	509.71	342.67	676.75
OCT 2025	517.89	348.26	687.52
NOV 2025	521.87	349.69	694.06
DEC 2025	522.49	347.78	697.20
JAN 2026	529.71	352.51	706.90
FEB 2026	534.06	354.41	713.72
MAR 2026	539.78	357.69	721.86
APR 2026	539.83	355.34	724.32
MAY 2026	542.17	355.30	729.03
JUN 2026	539.99	350.78	729.21
JUL 2026	541.98	350.44	733.52
AUG 2026	532.19	338.34	726.03
SEP 2026	533.15	337.03	729.27
OCT 2026	541.33	342.96	739.71
NOV 2026	545.31	344.70	745.93
DEC 2026	545.93	343.11	748.76
JAN 2027	553.15	348.13	758.17
FEB 2027	557.50	350.31	764.70
MAR 2027	563.22	353.87	772.57
APR 2027	563.27	351.79	774.76
MAY 2027	565.61	352.00	779.22
JUN 2027	563.44	347.73	779.14
JUL 2027	565.43	347.63	783.22
AUG 2027	555.63	335.76	775.49
SEP 2027	556.59	334.67	778.51
OCT 2027	564.77	340.82	788.73
NOV 2027	568.75	342.78	794.73
DEC 2027	569.37	341.38	797.36

For each model, forecasts start after the last non-missing in the range of the requested estimation period, and end at the last period for which non-missing values of all the predictors are available or at the end date of the requested forecast period, whichever is earlier.

Comment: from table 4.6, which indicate the forecast future values for the next 5 years, which we can conclude that there is increase in trend across the various years.

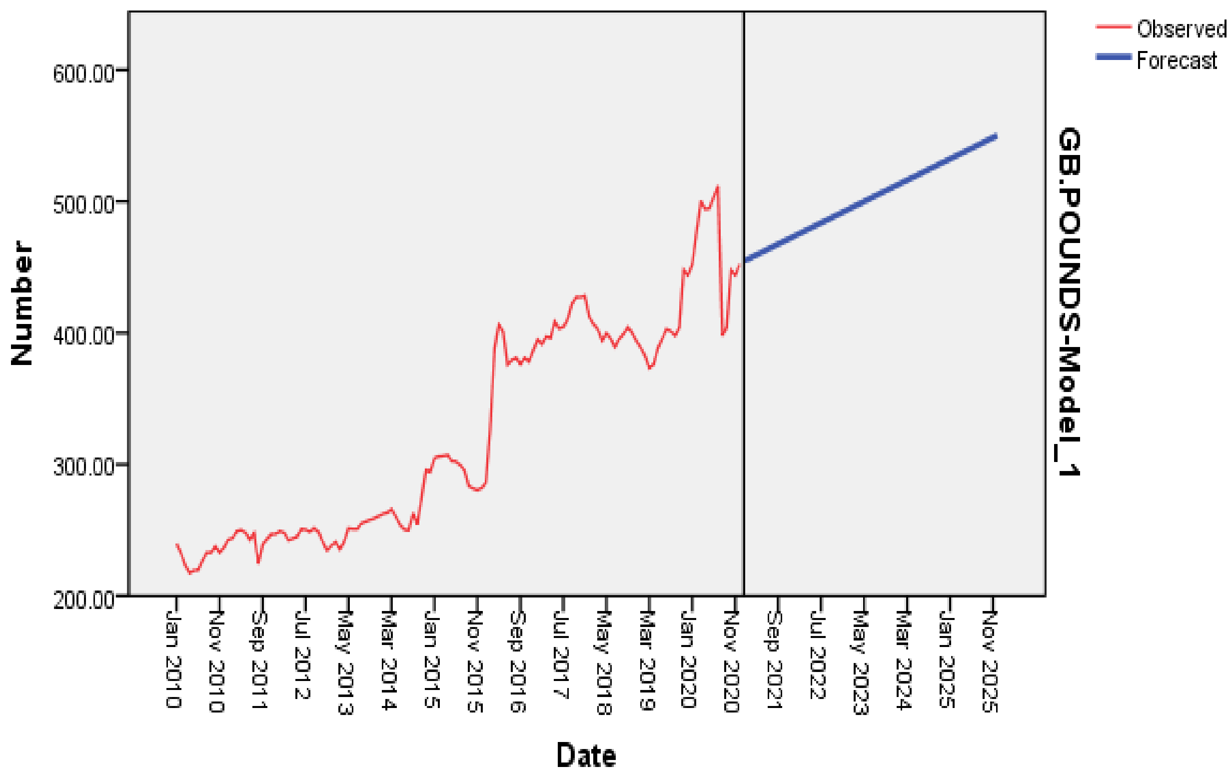

Fig 4.6

Comment: Fig 4.6 above shows the plotted line for the observe and forecast, which also illustrated that there is increase in trend across the various years.

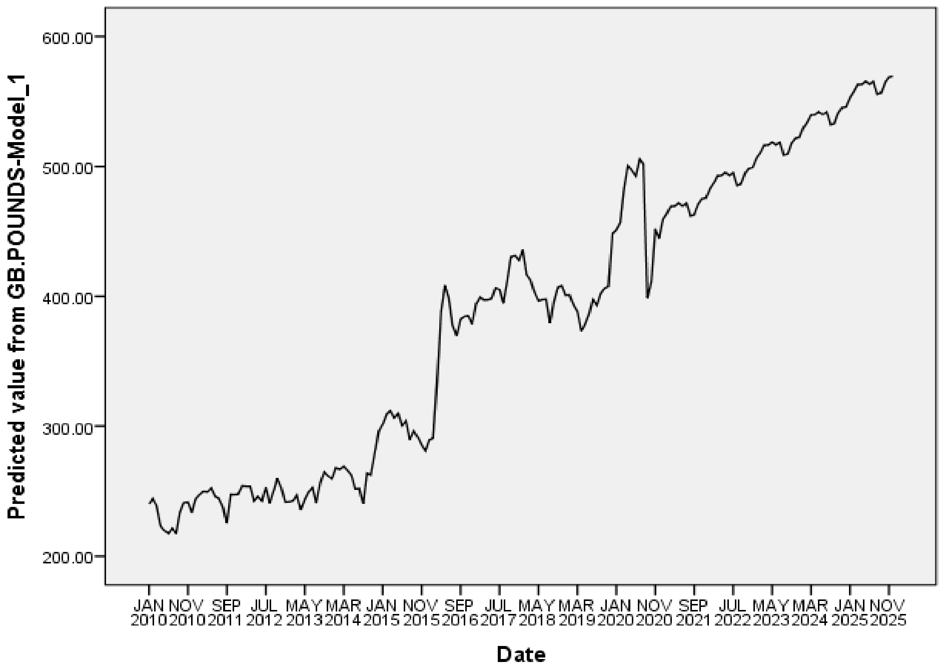

Fig 4.7 above shows the sequential series of the predicted value ($\hat{y}$) as well, which also back it up as well that the data is not stationary.

CHAPTER FIVE

5.0 SUMMARY OF FINDINGS, CONCLUSION AND RECOMMENDATIONS

5.1 SUMMARY OF FINDINGS

In summary of findings are;

i. Fig 4.1 shows the time series plot of data (GB POUNDS)
ii. The Fig 4.2 shows The ACF (autocorrelation function) of the differenced series on the GB POUNDS data shows a positive auto correlation at lag 1 which suggest AR [1],
iii. Fig 4.3 shows The PACF (partial autocorrelation function) shows a gradual attenuation from its initial value which also suggested MA [1].since we have differenced of our original data to be one [1] to obtain AR [1] and MA [1] patterns, our ARIMA identification includes one degree of auto regressive, one degree of differencing and one degree of moving average in conventionally ARIMA notation, we have tentatively identified an ARIMA [1, 1, 1].
iv. The acf and pacf of residuals in fig 2 clearly shows that the model is reasonable because the plotted residuals look like white noise {Independent zero mean random variables}, which means that the acf and pacf are theoretically 0 at all non-Zero lags. This indicates that the residuals do not have significant lagged acf and pacf so that is good for the model. And also table 1 (Model parameter block) shows which AR and MA terms were fit, the estimate values of their coefficients, the standard error of the estimate, the t-test statistic for the significance test and the p-values that test for the null hypothesis, which shows that Arima (1,1,1) is suitable for the data, also The model statistics table above described how best the model is, because the smallest the value of the stationary R-squared (0.036) the better the model. And also since the sig.value (0.722) > 0.05, therefore we hereby do not reject the null hypothesis and conclude that the model is best fitted and suitable for the data.

v. Fig 4.5 Shows the plotted line of the original data. It is clear from this figure that there is increasing trend in mean and variances in the time series i.e. is not constant. Which means the data is not stationary

vi. From the table 4.4, which shows the correlation between points separated by various time lags together with their various std error and as well as their significant values, which could be seen clearly that Lag 1 has the lowest value of 29.438 and

vii. table 4.5 and 4.6 shows the partial auto correlation function of the series as well, which could be seen clearly the Partial correlation point at Lag 1 has the highest value.

viii. Also Table 4.6 shows the saved predicted values for the original data and also predicted values for the forecast years.

ix. And lastly fig 4.6 shows the plotted line for the observe and forecast, which also illustrated that there is increase in trend across the various years.

5.2 CONCLUSION

The study has presented us with an opportunity to have an extensive understanding in the theory of time series. The stage in the model building has been explored and utilized the study. Based on the analysis, we observed that Arima (1,1,1) is the most suitable model for the data, and from the forecast values we can conclude that there is increase in GB POUNDS over the years.

5.3 RECOMMENDATIONS

Recommendations focused on studying the exchange rate of Great Britain Pounds (GBP) to Nigeria currency (NGN):

1. **Macroeconomic Determinants and Exchange Rate Dynamics**:

Macroeconomic Variables: Investigate the relationship between key macroeconomic variables (e.g., interest rates, inflation rates, GDP growth rates) in both the UK and Nigeria and the GBP-NGN exchange rate. Analyze how changes in these variables affect exchange rate movements over different time periods.

Exchange Rate Regimes: Study the impact of exchange rate regimes (e.g., fixed, floating, managed float) in both countries on the stability and volatility of the GBP-NGN exchange rate. Compare the effectiveness of different exchange rate policies in maintaining currency stability.

2. **Trade and Financial Flows**:

Trade Balance Analysis: Analyze the bilateral trade balance between the UK and Nigeria and its influence on the GBP-NGN exchange rate. Assess how changes in trade patterns, such as shifts in export and import volumes, affect the demand and supply dynamics of GBP and NGN in the foreign exchange market.

Financial Flows: Study the role of financial flows (e.g., foreign direct investment, portfolio investment, remittances) between the UK and Nigeria in influencing the GBP-NGN exchange rate. Examine how capital flows respond to exchange rate movements and economic conditions in both countries.

3. **Political and Geopolitical Factors**:

Political Stability: Investigate how political stability and governance issues in Nigeria and the UK impact investor confidence and exchange rate stability. Analyze the reactions of the exchange rate to political events such as elections, policy announcements, and geopolitical tensions.

Geopolitical Events: Assess the influence of international geopolitical events (e.g., Brexit, global trade tensions) on the GBP-NGN exchange rate. Study how changes in global political dynamics affect currency risk perceptions and investor behavior.

4. **Market Sentiment and Behavioral Analysis**:

Sentiment Analysis: Apply sentiment analysis techniques to financial news, social media discussions, and expert opinions to understand market sentiment towards the GBP-NGN exchange rate. Analyze how sentiment-driven factors such as market expectations, perceptions of risk, and investor sentiment influence exchange rate movements.

Behavioral Finance: Utilize behavioral finance theories to study irrational behaviors and biases in the GBP-NGN exchange rate market. Explore phenomena such as herding behavior, overreaction, and underreaction among market participants.

5. **Forecasting and Predictive Modeling**:

Forecasting Models: Develop and compare different forecasting models (e.g., econometric models, time series models, machine learning approaches) to predict future movements in the GBP-NGN exchange rate. Evaluate the accuracy and robustness of these models across different time horizons and market conditions.

Scenario Analysis: Conduct scenario analysis to assess the potential impact of alternative economic scenarios (e.g., economic growth rates, policy changes) on the GBP-NGN exchange rate. Explore how different scenarios may lead to varying exchange rate outcomes and implications for stakeholders.

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