ASSESSING THE IMPACT OF INFLATION AND EXCHANGE RATE ON NIGERIAN GROSS DOMESTIC PRODUCT (1981-2022)

Abstract

This study evaluated the impact of inflation and exchange rate on the Nigerian Gross Domestic Product (GDP) from 1981 to 2022. The data for this study were obtained from Central Bank of Nigeria Statistical Bulletin. Multiple Linear Regression model was adopted for the study to determine the relationship between the GDP, the inflation and exchange rates and the result showed that there is a significant relationship with the p-value(0.005). The result also showed with Ordinary Least Square(OLS) method that inflation rate has a negative impact on the Nigerian GDP while exchange rate is significant with (p-value <0,005) over the years of study. The value of the coefficient of variation R^2 for this research is 92.2% indicating that inflation and exchange rate account for about 92% of the variation in the GDP over the years of study.It was observed there was an increase in exchange rate and price level is also detrimental to the economic growth, this means it contributes to the growth of Nigerian GDP over the period of study.

***Keywords**: Gross Domestic Product (GDP), Inflation Rate, Exchange Rate, Ordinary Least Squares Method (OLS)*

1.0 INTRODUCTION

"Exchange rate refers to the amount of units of an economy's currency (the home country) when it comes to another economy's currency. Exchange rate is significant because it helps to ensure exchange of goods and services among different countries, it determines the level of imports and exports and also helps to set domestic prices as well as maintain a balance in the economy.Exchange rate policies in developing countries are often sensitive and controversial, mainly because of the kind of structural transformation required, such as reducing imports or expanding non-oil exports, which invariably imply a depreciation of the nominal exchange rate. Such domestic adjustments, due to their short-run impact on prices and demand, are perceived as damaging to the economy", Akpan and Atan (2010)."Ironically, the distortions inherent in an overvalued exchange rate regime are hardly a subject of debate in developing economies that are dependent on imports for production and consumption. The debate rather focuses on the degree of fluctuations in the exchange rate in the face of internal and external shocks. There appears a consent view on the fact that devaluation or depreciation could boost domestic production through stimulating the net export component. This is evident through the increase in international competitiveness of domestic industries leading to the diversion of spending from foreign goods whose prices become high, to domestic goods. The success of currency depreciation in promoting trade balance largely depends on switching demand in proper direction and amount as well as on the capacity of the home economy to meet the additional demand by supplying more goods. On the whole, exchange rate fluctuations are likely, in turn; to determine economic performance, see, for example",Guitan (1976). "It is therefore necessary to evaluate the effects of exchange rate fluctuations on output growth and price inflation. In Nigeria, the exchange rate policy has undergone substantial transformation from the immediate post-independence period when the country maintained a fixed parity with the British pound, through the oil boom of the 1970s, to the floating of the currency in 1986, following the near collapse of the economy between 1982 and 1985 period. In each of these epochs, the economic and political considerations behind the exchange rate

policy had important effects for the structural evolution of the economy, inflation, the balance of payments and real income. Specifically, the possible direct and indirect relationships are investigated. Some previous attempts have been made to conduct econometric studies on exchange rate determination and the movements in output in Nigeria", see for example, Egwaikhide, et al (1994); Akinlo and Odusola (2001),Mordi (2006); Fatukasi (2012); Benson and Victor (2012) noted that d"espite various Governments' efforts to maintain a steady and stable exchange rate in Nigeria, the Naira continue to depreciate in value from time to time.In the course of the most recent decades, a few developing countries utilized rigid trade controls to secure their domestic businesses. Today, a numerous financial experts have credited the monetary plunging some to these equivalent protectionist strategies". Ewa (2011) concluded that "the exchange rate of the Naira was relatively stable during the post-independence period when agricultural merchandise reckoned for greater than 70% of the nation's GDP, and during the oil boom era between 1973 and 1979, when crude oil became the country's major export. This resulted in a major decline in the volume of agricultural products in overall exports while crude oil increased, as a result of its higher revenue margins. This marked the beginning of the Nigeria's dependence on oil exports and the subsequent volatility of its exchange rate. Although the government has implemented different measures pointed toward enhancing the fare base, for example, impetuses to advance fare of semi- prepared and handled products so as to increment unfamiliar trade profit, by means of the private area, the significant level of importation to address home grown issues continues to put a strain on the economy". This major goal of this study is to ascertain if the effect of the exchange rate and inflation rate have a direct impact on Nigeria's economic growth.

2.0 SOME EMPIRICAL REVIEW

Some empirical evidences have shown strong effect of short-run and long-run adverse effect of exchange rate fluctuations on economic growth performance throughout the trade channel. The nature of the effect, however, runs in either positive or negative direction.

Barro (1995) used "data for 100 countries from 1960 to 1990 to investigate the effects of inflation on economic performance by using the instrumental variable estimation method. He found that a 10 percentage point increase in average inflation per year yielded a reduction in growth rate of real per capita GDP of between 0.2 and 0.3 percentage points. He further noted that the inclusion of high inflation experiences in the growth regressions yielded more statistically significant results and stated that the direction of causation runs from higher inflation to reduced growth".

Faira and Carneiro (2001) examined "the linkage between inflation and economic growth in Brazil for the period between 1980 and 1995 and the resultrevealed a significant negative relationship in the short run while in the long run showed insignificant effect on economic growth. This could be a situation where the scope of production can change to absorb the lag of excess demand". Omoke and Oruta,(2010) affirmed"the result of Faira and Carneiro to support the neutrality concept of money but however, found that inflation affects economic growth in the long run as found by some other researchers".Eichengreen and Lablang (2003) found "strong negative relationship between exchange rate stability and growth for 12 countries over a period of 120 years and they concluded that the result of such estimations strongly depended on the time period and the sample".Erbaykal and Okuyan (2008) observed "the relationship between inflation and economic growth for Turkey from the period of 1987 to 2006 and the result showed that there exists a negative and significant relationship in the short run but no significant relationship was found

between the two variables in the long run. They further carried out causal relationship between the two variables with the findings showing a unidirectional causality relationship from economic growth to inflation".Aliyu, et al (2009) examined "exchange rate pass-through in Nigeria for the period 1986 to 2007. Quarterly series was employed and a vector Error Correction Model estimation was used in the estimation process. The authors found that exchange rate pass-through in Nigeria during the period under consideration was low and declined along the price chain, which partly overturns the conventional wisdom in the literature that exchange rate pass-through is always considerably higher in developing countries than developed countries. The authors concluded that in the long run, pass through would likely increase and monetary policy should be designed to accommodate the effect".Omoke and Oruta (2010) made "use of data covering the period of 1970 to 2005 to find out relationship between inflation and economic growth in Nigeria". The study adopted Johansen-Juselius Co-integration technique which is considered superior to Engle and Grager (1987) in establishing co-integration properties of variables in a multivariate context. "The results revealed a no co integrating relationship between inflation and economic growth in Nigeria. The study further made use of VAR-Granger causality at two lag periods and found a unidirectional causality running from inflation to economic growth and the study therefore concluded that inflation has an impact on economic growth". [34]Fakhri (2011) examined"the effect of Inflation on economic growth from 2000 to 2009 in Azerbaijan. The variables used were inflation proxy by consumer price index, growth rate of real gross fixed capital formation and real gross domestic product growth. A non-linear nexus of inflation and economic growth was revealed after an estimated threshold model, 13 per cent was discovered as the threshold point of inflation for growth of the economy. When the rate of inflation is above the 13 per cent threshold, its influence on economic growth becomes negative and the reverse is the case when inflation is below the 13 per cent threshold".Vaona (2012) established "the threshold of annual inflation increase to be around 1 percent for developed countries while that of developing country which Nigeria belongs at 11%". Ahmed and Mortaza (2015) empirically established "a statistically significant negative relationship between inflation and economic growth using CPI and real GDP as proxy variables for Bangladesh for the period between 1980 and 2016". Kogid, et al (2012) contemplated "the effect of conversion scale on monetary development in Malaysia utilizing time-arrangement information for the period 1971 - 2009. The ARDL Bounds test was utilized to investigate the information. The investigation found that a since quite a while ago run co-combination exists between swapping scale (ostensible and genuine) and financial development. Consequently, conversion scale significantly affected monetary development". Sweidan (2013) examined "the possibility of the relationship between inflation and economic growth having a structural breakpoint effects for Jordanian economy covering the period of 1970 to 2013 and the result showed a positive and significant relation between GDP and economic growth". Oladapo and Oloyede (2014) examined "the impact of exchange rate management on the level of economic growth in Nigeria from 1990-2012, the study employed the OLS (ordinary least squares) methodology and the ECM (error correction model), and they result demonstrate that exchange rate, import, export and money supply has a positive relationship with economic growth". Eze and Okpala (2014) tested "the impact of the two exchange rate policy (fixed and floating) practiced in Nigeria using annual data covering from 1980-2012. It was find again that exchange rate moved around the same direction with trade in the long run. The research split the period in two- before and after the introduction of the SAP. After conducting a chow test, they showed that there is no statistically significant impact of the exchange rate regime of economic growth". Victor and Asaleye (2016) investigated "the effect of exchange rate fluctuation on economic growth from 1990-2014. They

employed the Autoregressive Distributed Lag model (ARDL), and based on their sample, they found no effect of exchange rate fluctuations on economic growth in the long run. However, in the short run an effect exists".Anidiobu, et al (2018) examined"the impact of inflation on economic growth in Nigeria from the period of 1986-2015. Data was sourced from the website of Central Bank of Nigeria (CBN). Descriptive statistics and Ordinary Least Square (OLS) estimation technique were used to estimate the variables. Real Gross Domestic Product is the proxy for economic growth (dependent variable) while, the inflation rate, exchange rate and Interest rate were the independent variables. The findings revealed that the rate of inflation has a positive and insignificant effect on economic growth in Nigeria". Adaramola and Dada (2020) examine "the effect of inflation on economic growth from 1980 to 2018. Time series data on inflation rate, government consumption expenditure, exchange rate, supply of money, rate of interest, degree of openness and real GDP was utilized for the study. The study employed ARDL model, test for normality, cumulative sum test, heteroscedasticity test, and serial correlation LM test. Results found that interest rate and money supply have a direct linkage with the economic growth; while, exchange rate and inflation have an inverse relationship with economic growth". Having reviewed some empirical works of the above authors, we also found that there are many researchers on the inflation and exchange rates both locally and internationally, see, for example, Adeniran, et al (2014); Tiwari and Sharma (2015); Akinlo and Lawal (2015); Alasha (2020); Eme and Johnson (2018); Gatawa and Mahmud (2017); Micheal (2018); Umaru, et al (2013) and Wasiu, et al(2019).

3.0 MATERIALS AND METHOD

3.1 Data Description

The data used for this study are annual time series data from 1981to 2022 and of secondary type obtained from the Central Bank of Nigeria (CBN) Statistical Bulletin and National Bureau of Statistics (NBS).

3.2. Model Specification

The model for this study is specified as

$$GDP = \beta_0 + \beta_1 EXR + \beta_2 INF + \mu_t \tag{1}$$

Where,

GDP represents the economic growth of Nigeria,

EXR represents the exchange rate.

INF represents inflation rate.

μ is the stochastic or error term.

Mathematically, Equation (1) will be represented as follows.

$$Y_t = \beta_0 + \beta_1 X_1 + \beta_2 X_2 + \mu_t \tag{2}$$

Where,

Y_t is the dependent variable (GDP)

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X_i is the independent variable or Explanatory variables (Exchange rate and Inflation rate)

3.3. METHOD OF DATA ANALYSIS

The method of data analysis adopted for this study is Multiple Linear Regression Mode. This model expresses a linear relationship between dependent variable (GDP) and the two independent variables including Exchange Rate (EXR) and Inflation Rate (INF). The relationship written mathematically is expressed as in Equation (1)

3.3.1 Estimation of the parameters of the model

By the application of Ordinary Least Square Method (OLS) to equation (2), we obtain the following two normal equations;

$$\hat{\beta}_1 \sum X_1^2 + \hat{\beta}_2 \sum X_1 X_2 = \sum X_1 Y \tag{3}$$

$$\hat{\beta}_1 \sum X_1 X_2 + \hat{\beta}_2 \sum X_2^2 = \sum X_2 Y \tag{4}$$

Equations (3) and (4) would be simplified further in a deviation form as to obtain the followingmatrix formation

$$\begin{pmatrix} \hat{\beta}_1 \\ \hat{\beta}_2 \end{pmatrix} \begin{pmatrix} \sum x_1^2 & \sum x_1 x_2 \\ \sum x_2 x_1 & \sum x_2^2 \end{pmatrix} = \begin{pmatrix} \sum x_1 y \\ \sum x_2 y \end{pmatrix} \tag{5}$$

For the estimate of $\hat{\beta}_1$ and $\hat{\beta}_2$, we obtain the following inversematrix

$$\begin{pmatrix} \hat{\beta}_1 \\ \hat{\beta}_2 \end{pmatrix} \begin{pmatrix} \sum x_1^2 & \sum x_1 x_2 \\ \sum x_2 x_1 & \sum x_2^2 \end{pmatrix}^{-1} = \begin{pmatrix} \sum x_1 y \\ \sum x_2 y \end{pmatrix}$$

and $\hat{\beta}_0$ can be obtained through the relation

$$\hat{\beta}_0 = \frac{\sum Y}{n} - \hat{\beta}_1 \frac{\sum X_1}{n} - \hat{\beta}_2 \frac{\sum X_2}{n} \tag{6}$$

3.3.2 Test of Hypothesis on the $\hat{\beta}_1$ and $\hat{\beta}_2$

Here, we would conduct a statistical test of hypothesis on whether there exist a significant relationship between the Gross Domestic Product (GDP) on the Exchange Rate and Inflation Rate. This is to test if there is any significantinfluence of the Exchange rate and inflation rate on the GDP the Regression Analysis and test of significance of the parameters.

The Regression Analysis

This test involves testing whether Exchange Rate (X_1) and Inflation Rate (X_1) are jointly related to GDP.

The Null and Alternate hypotheses of the test can be stated as

$H_0 : \beta_1 - \beta_2 = 0$ (No significant relationship)

$H_1 : \beta_1 - \beta_2 = 0$ (Significant relationship exist)

The test can be conducted using the Analysis of variance (ANOVA) techniques developed as follows

Total sum of square, $TSS = \sum y^2$ (7)

Regression sum of square , $RSS = \hat{\beta}_1 \sum x_1 y + \hat{\beta}_2 \sum x_2 y$ (8)

Error sum of square , $ESS = TSS - RSS$ (9)

Regression mean square and the mean square Error respectively are obtained by dividing the regression sum of square with appropriate degree of freedom given as

$$MS_R = \frac{RSS}{k}$$ (10)

and

$$MS_E = \frac{ESS}{n-k}$$ (11)

where,

k is the number of parameters and n is the number of observations

The corresponding Analysis of variance (ANOVA) table of test would be obtained as

Table 1: Analysis of Variance (ANOVA) Table

Source of variations	Degree of freedom	Sum of squares	Mean square	F-ratio
Regression	k	RSS	MS_R	
Error	$n-k$	ESS	MS_E	$MS_R \big/ MS_E$
Total	$n-1$	TSS		

Where the F-ratio is compared with the value obtained from F-distribution table with $(k, n-k)$ degrees of freedom at a level of significance, The null hypothesis H_0 of no

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significant on GDP and the two sectors would be rejected if the F- ratio is greater than the value obtained from F-distribution table, otherwise H_0 would not be rejected,

The Test of Significance of Parameters

This test involves testing whether each of the sectors Exchange Rate (X_1) and Inflation (X_2) has any influence on the GDP when any of them is held constant.

The Null and alternative hypotheses of the test can be stated as

$H_0 : \hat{\beta}_i = 0$ (any of the sectors is not related to GDP)

$H_1 : \hat{\beta}_i \neq 0$ (any of the sectors related to GDP

The test statistic is given by

$$t = \frac{\hat{\beta}_i}{S.E(\hat{\beta}_i)}, i = 1,2 \text{ (Exchange rate and Inflation rate)} \tag{12}$$

where,

$S.E(\hat{\beta}_i)$ is the standard error of the parameter estimates

The decision rule would be to reject the null (H_0) at α-level of significant if the value of the test statistic is greater than the value obtained from t-distribution table with $t_{\alpha/2, n-k}$ degrees of freedom and hence, conclude that a relationship exist between GDP and the two sectors, and accept (H_0) otherwise.

3.3.3. Multiple Co-efficient of Determination.

The multiple coefficient of determination (R^2) is a key output of regression analysis can be used in this research to interpret the proportion of the variance of the dependent variable (GDP) that is predictable for the independent variables (Exchange rate and Inflation rate)

The formula for multiple coefficient of Determination for the works is given by

$$R^2 = 1 - \frac{ESS}{TSS} \tag{13}$$

If R^2 is high it indicates that exchange rate (X_1) and Inflation rate (X_2) are important sectors in the determination of the values of Gross Domestic Product (Y)

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4.0 RESULTS AND DISCUSSIONS

Table 2 Descriptive Statistics of GDP, Exchange Rate and Inflation Rate

	N Statistic	Sum Statistic	Mean Statistic	Std. Error	Std. Deviation Statistic
GDP	42	1820368.80	43342.1143	9829.31549	63701.24493
INFLATIONRATE	42	798.28	19.0067	2.53973	16.45934
EXCHANGERATE	42	5301.90	126.2357	24.51675	158.88671
Valid N (listwise)	42				

From the output of the descriptive statistics, it showed that both inflation and exchange rate with the standard means 79.8 per cent and 5301.90 naira respectively whereas inflation and interest rates are associated with mean values of 19.0067and 126.2357 per cent respectively. The standard deviations showed that all the variables are convergent to their respective mean values with the exception of GDP growth.

4.2 Plots of GDP, Exchange Rate and Inflation Rate over the years of study
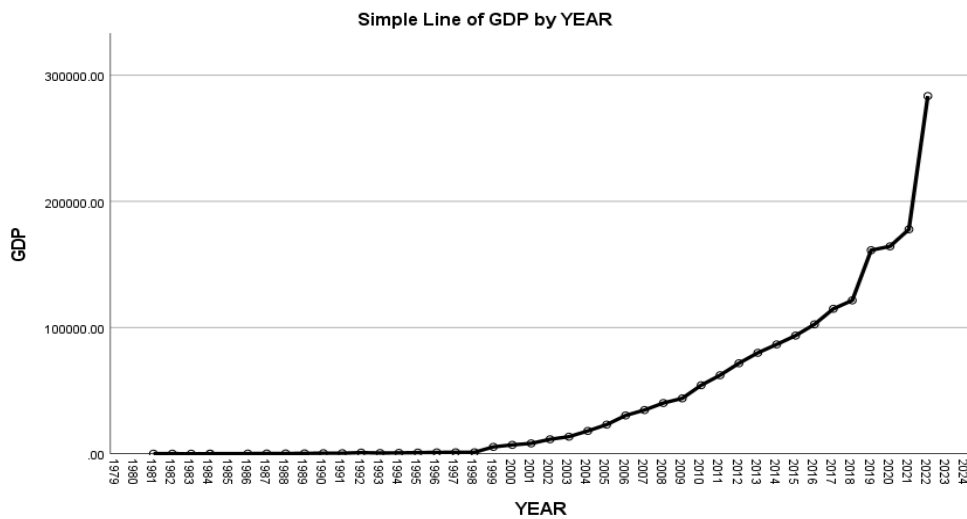

Figure 1 Time Series plot on GDP over the years of study

Figure 1shows the time series plot of GDP from 1981 to 2022. From the plot, we observed that GDP was steady from 1981 to 1998 (no increase or movement) but moved slightly from 1999 to 2003 (slight increments) and moved increasingly from 2004 to 2022. The plot shows that GDP increased significantly from 2004 to 2022 as the period of study.
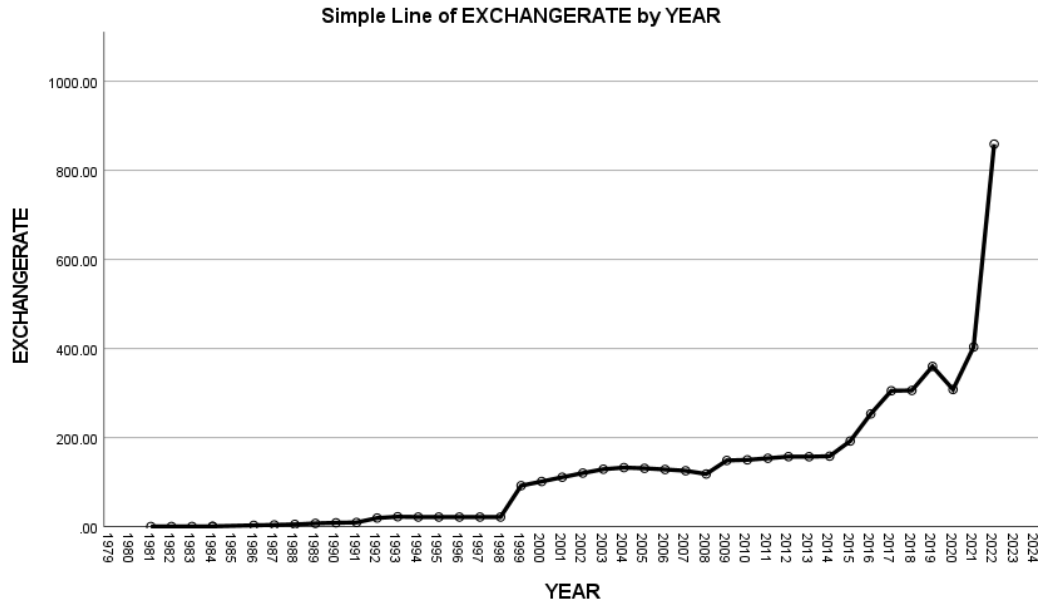
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Figure 2. Time Series plot of Exchange Rate over the years of study

Figure 2 is a plot of Exchange rate from1981 to 2022. The plot revealed that exchange has no impact on the Nigerian Economy between 1981 and 1998 but contributed significantly to the economy between 1999 and 2022. This means that Exchange rate has significant impact to Nigerian GDP from 1999 to 2022 (Democracy era).
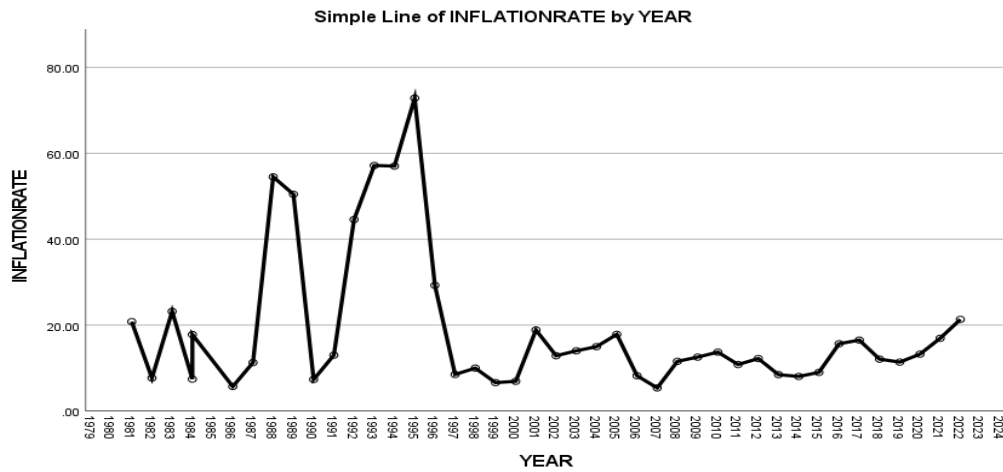

Figure 3. Time series plot of inflation rate over the years of study

 From Figure 3, we observed that inflation rate is not steady throughout the period of study. From 1981to 2022 there were a lot fluctuations found in the inflation rate. This means that inflation rate over the years of study showed no significant impact on the Gross Domestic Product of Nigerian Economy.

4.3 Multiple Regression Model for the Analysis

The Regression model obtained for the data in given by

$$GDP = -3932 + 379EXR - 62INF + \mu_t$$

Table 3. The Analysis of Variance (ANOVA) Table of Regression Model

Model		Sum of Squares	Df	Mean Square	F	Sig.
1	Regression	1.54043E+11	2	77021340894	243.64	.000[b]
	Residual	12329092317	39	316130572		
	Total	1.66372E+11	41			

a. Dependent Variable: GDP
b. Predictors: (Constant), EXCHANGERATE, INFLATIONRATE

Decision of Result: From the output in Table 3, we observed that since the p-value is less than 0.05 we reject the null hypothesis of no relationship and conclude that there is a significant relationship between the Gross Domestic Product (GDP) and inflation and exchange rate over the years of study.We also observed that the new multiple regression model has an adequate predictive ability that is it explained about 91% of impact of exchange rate and inflation to the GDP during the period of study.

Table 4 Summary of the Regression Coefficients

Coefficients[a]

Model		Unstandardized Coefficients B	Std. Error	T	Sig.
1	GDP (Y)	-3932	5126	-0.77	.448
	EXCHANGERATE	378.72	17.58	21.54	.000
	INFLATIONRATE	-62.4	172.2	-0.36	.719

a. Dependent Variable: GDP

From the output in Table 4, it showed that there is no significant relationship between the GDP and exchange rate since the p-values < 0.05 (0.00< 0.05), hence,we, reject H_0 and conclude that there is a significant relationship between them; and also we accept H_0 that there is no significant relationship between GDP and Inflation rate since the p- value is < 0.05.

Table 5 The coefficient of Determination R^2

Model Summary

Model	R Square	Adjusted R Square	Std. Error of the Estimate
1	92.6	92.2	17780.1

a. Predictors: (Constant), EXCHANGERATE, INFLATION RATE

The R^2 (92.2) is a goodness of fit test which shows the amount of the variation in the dependent variables (GDP) that are explained by inflation and exchange rate. The value of the R^2 for this research is 92.2% indicating that inflation and exchange rate account for about 92% of the variation in the GDP over the years of study.

5.0 CONCLUSION

The Multiple Regression Model of GDP of the two selected sectors including inflation and exchange rate of the economy has a good fit with the p-value of 0.000 which is less than α-level of 0.05. The parameters of the model were tested for goodness of fit, the test indicates that exchange rate was significant to GDP while Inflation rate was insignificant to the GDP. This means the Exchange rate has significant impact to GDP over the years while Inflation rate has no impact to GDP over the years. Hence, the findings indicatethat the model fit the data well and has adequate predictive capability in terms of informative strength.Based on the findings, this study concludes that increase in exchange rate undermines the growth of the Nigerian economy and equally concluded that inflationary pressures also dampen economic growth in Nigeria

5.0 RECOMMENDATION

The study recommends that:

1. The government should try to check the floating exchange rate usually characterized with unanticipated exchange rate volatility, which is subject to both exporter and importer.
2. The federal government through the CBN should ensure that exchange rate policy should is consistent to provide opportunity for a realistic and stable exchange rate capable of driving economic growth in Nigeria.
3. The monetary policy committee (MPC) should ensure that interest rate remain at a level capable of promoting investments to enhance economic growth in Nigeria
4. Incentives should be provided for small scale manufacturing industries, to ease cost of production and enable them increase output level in terms of both quality and volume

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Appendix

Table 1 A GDP, Exchange Rate and Inflation Rate from 1981 to 2022

YEAR	GDP (Y)	EXCHANGE RATE (#)	INFLATION RATE(#)
1981	104.76	0.636900	20.81
1982	95.17	0.670200	7.70
1983	72.68	0.748600	23.21
1984	59.39	0.808300	17.82
1985	73.72	0.999600	7.44
1986	181.78	3.316600	5.72
1987	220.81	4.191600	11.29
1988	265.78	5.353000	54.51
1989	336.60	7.650000	50.47
1990	486.37	9.000100	7.36
1991	479.14	9.754500	13.01
1992	939.59	19.66090	44.59
1993	628.00	22.63090	57.17
1994	740.41	21.88610	57.03
1995	964.30	21.88610	72.84
1996	1,117.94	21.88610	29.27
1997	1,191.92	21.88608	8.53
1998	1,194.97	21.88600	10.00
1999	5,482.23	92.3400	6.62
2000	7,063.07	101.7000	6.93
2001	8,234.36	111.2300	18.87
2002	11,502.17	120.5800	12.88
2003	13,556.47	129.2200	14.03
2004	18,124.87	132.8900	15.00
2005	23,120.59	131.2700	17.86
2006	30,374.27	128.6500	8.23

2007	34,677.01	125.8100	5.39
2008	40,245.35	118.5500	11.58
2009	43,926.99	148.9000	12.56
2010	54,327.44	150.3000	13.72
2011	62,259.45	153.8600	10.84
2012	71,741.25	157.5000	12.22
2013	80,022.02	157.3100	8.48
2014	86,676.11	158.5500	8.06
2015	93,679.79	192.4400	9.01
2016	102,574.73	253.4900	15.68
2017	114,900.59	305.7900	16.52
2018	121,571.92	306.0800	12.09
2019	161,349.82	360.0594	11.40
2020	164,380.69	380.2556	13.25
2021	177,890.35	403.5808	16.95
2022	283534.23	859.09	21.34

Source: National Bureau of Statistics (NBS)