International Journal of Research in Finance and Management

P-ISSN: 2617-5754
E-ISSN: 2617-5762
IJRFM 2022; 5(2): 226-232
Received: 03-09-2022
Accepted: 07-10-2022

Abdullahi Bashir Muhammed
School of Management, Universiti Sains Malaysia

Ahmed Tijani Abdulmajeed
Kogi State University, Anyigba, Nigeria

Correspondence
Abdullahi Bashir Muhammed
School of Management, Universiti Sains Malaysia

Impact of naira redesign and monetary policy on Nigeria economy

Abdullahi Bashir Muhammed and Ahmed Tijani Abdulmajeed

DOI: https://doi.org/10.33545/26175754.2022.v5.i2c.173

Abstract
Naira redesign is typically carried out to prevent naira counterfeiting and control the amount of money in circulation lowering inflation and is also a good monetary policy. The sole aim of this study is to examine the effects of monetary policy and the redesign of the Naira on the Nigerian economy. The secondary data used was taken from World Bank publications published between 1970 and 2021. While accounting for inflation, the regression model demonstrates a significant relationship between GDP and monetary policy. The model also demonstrates that the exchange rate and interest rate coefficients have a positive and significant impact on Nigeria's GDP, whereas the inflation rate coefficient has a negative and significant impact. The unit root test was also used, and the results demonstrate that all of the variables are ordered-one integrated. According to the Johansen cointegration analysis, the GDP, exchange rate, interest rate, and inflation have a long-term relationship. This demonstrates unequivocally that monetary policy, when properly applied by the federal government via the central bank of Nigeria, has a positive significant impact on the Nigerian economy. To prevent Naira notes counterfeiting, remove about 80% of Naira currency outside of commercial banks, and also to mitigate the inflation rate that has essentially driven Nigeria into recession, the government should strictly implement the Naira redesign decision from time to time through the Nigeria apex bank. This will positively affect the Nigerian economy.

Keywords: Naira redesign, monetary policy, regression model, unit root test, cointegration analysis

1. Introduction
As a result of the COVID-19 pandemic hurt the world economy, particularly Nigeria's economy, monetary policymakers have been developing various strategies, such as the redesign of the Naira, to control inflation and stabilize the economy (McKay *et al*., 2016 [9]; CBN, 2022) [12]. As the top federal government bank in Nigeria, the central bank's responsibility is to manage inflation and prevent the counterfeiting of naira notes. The central bank of Nigeria has the sole authority to print and redesign the Naira to remove corrupt money from the system, control the amount of cash in circulation to lower inflation, maintain a robust security system by discouraging voting fraud and kidnapping, and ensure a successful cashless economy that reduces misuse of Naira notes and causes the Naira to appreciate over time. The central bank of Nigeria's governor recently announced the redesign of the naira with the express goals of removing black market funds from the system, reducing crime, and reducing inflation (Emefiele, 2022) [6]. But the redesign of the Naira is not a new thing; it has already been done in the past. Other nations, including the USA, the UK, and others, have also changed the look of their money.

The #1000 note was issued in 2005, while the #5, #10, #20, and #50 notes were redesigned in 2007. However, the #200, #500, and #1000 notes will be redesigned in 2022 with the federal government's approval (CBN, 2022 [12]; Buhari, 2022) [6]. Although there have been a variety of responses from the public regarding the timing of the Naira redesign in light of the unusually high Naira to dollar exchange rate caused by the deficit in the balance of payments, market interactions, and high inflation, which in turn led to a steady increase in unemployment as many businesses are struggling to survive (CBN, 2022) [12]. To manage inflation, money hoarding, and counterfeiting, the central bank of Nigeria supervises monetary policy, one of which is the redesign of the Naira. By examining the effects of the Naira redesign, a component of monetary policy in Nigeria's economy, this research will

significantly advance knowledge in a new field of study. While the GDP will serve as a proxy for Nigeria's economic growth, the redesign of the naira is a good monetary strategy that is proxied by important indicators like the interest rate and exchange rate. Therefore, the main goal of this research is to evaluate how the Naira redesign and monetary policy have affected Nigeria's economic growth.

2. Literature review

This study explores the existing literature for this study and will present a theoretical and empirical review in this section.

2.1 Theoretical review

According to the Keynesian theory, the Naira redesign, which is a component of sound monetary policy, makes a substantial contribution to the GDP and the country's exchange rate, both of which lead to economic growth. This expression is shown by the following straightforward equation:

$$Y = NairaR + EXR \quad (1)$$

Where Y represents the total output (GDP), while the monetary policy indices are naira redesign (NairaR) and exchange rate (EXCH).

Nevertheless, apart from the gross domestic product (GDP) and exchange rate, the inflation rate is another critical macroeconomic variable. The survival of the Nigerian economy is solely dependent on the macroeconomic instruments and monetary policy regulation from time to time which is also proxied by interest rate (INTR) apart from the exchange rate (Alasha, 2020) [3].

In light of this, we can deduce the second equation with inclusion of the above variables as:

$$Y = F (INT, EXCH, INF) \quad (2)$$

Where Y = Gross Domestic Product (GDP)
INTR = Interest Rate
EXCH = Exchange Rate
INF = Inflation Rate

Hypothesis development

It is essential to set a hypothesis to examine the impact of the naira redesign being a monetary policy proxied by interest rate and exchange rate on the GDP which is a proxy for economic growth.

Alisha (2020) [14] carried out a study about the link between exchange rate fluctuation and its impact on Nigerian economic growth. He finds out that the inflation rate and exchange rate hurt GDP while the interest rate has a positive impact. Based on this, three hypotheses were set for this study.

H_1: The Inflation rate has a negative impact on GDP
H_2: The Exchange rate has a negative impact on GDP
H_3: The Interest rate has a positive impact on GDP

2.2 Empirical review

Alisha (2020) [14] used the exchange rate, interest rate, inflation rate, and trade balance as variables and data from the Central Bank of Nigeria statistical bulletin and publications from the National Bureau of Statistics to examine the relationship between exchange rate fluctuations and their effects on the growth of the Nigerian economy. Several methods, including the Augmented Dickey-Fuller test, Cointegration, and Granger Causality test, were used to analyze the data in addition to the typical least-squares approach (OLS) and the traditional least-regression model. According to the findings, exchange rates and inflation rates are detrimental to GDP while interest rates are beneficial. Adeniran, Yusuf, and Adeyemi (2014) [1] used secondary data from the Central Bank of Nigeria Statistical Bulletin along with correlation and regression analysis of the ordinary least square (OLS). They looked at how changes in exchange rates affected Nigeria's economic growth between 1986 and 2013. Their findings confirmed earlier research suggesting that developing countries should generally prefer flexible exchange rate regimes, showing that exchange rates have a positive but not very significant impact on economic growth. Furthermore, their study found that while interest rates and inflation generally harm economic growth, they don't do so particularly. The exchange rate significantly affects the determination of both short- and long-term macroeconomic growth and development goals, according to economic literature (Ehikioya 2019 [5]; Alagidede and Ibrahim 2017) [2]. Recent studies looked at the relationship between the exchange rate and economic growth (Morina *et al*. 2020[10]; Ioan *et al*. 2020) [7]. Morina *et al*. (2020) [10], who studied the effects of real exchange rate instability, concluded that growth requires little exchange rate volatility. Trade openness and fixed capital formation were also supported by the study, which used the fixed effect model of analysis, as additional factors that support long-term economic growth in the Central and Eastern European nations. According to Balcilar *et al*. (2019) [4], who focused on these two countries, South Africa was found to have stickier prices than Nigeria in the study that examined how the volatility of currency rates affected inflation in both countries. Munthali *et al*. (2010) [11] acknowledged that real effective exchange rate shocks hurt Malawi's GDP and discovered a weak but statistically significant correlation between these variables. A real exchange rate depreciation for the country may lead to inflation, but it may also tend to encourage exports and, as a result, improve economic performance, according to Mahoney and hypothesis. They made this claim in a study on how currency rate fluctuations affect inflation and how those changes then affect Zimbabwe's economic expansion. The relationship between the country's exchange rate devaluation and GDP is not discussed in this argument. After examining the connection between GDP, exchange rate pass-through, and copper prices in Zambia, Roger *et al*. (2019) [13] concluded that a drop in inflation was a reliable indicator of exchange rate volatility. According to the analysis above, different people have different viewpoints on the links between exchange rate volatility, inflation, interest rates, and economic growth. However, the vast majority of investigations supported a negative correlation between inflation and GDP or between exchange rate volatility and economic growth. Therefore, the primary objective of this study is to evaluate the impact on the Nigerian economy of the redesign of the Naira and monetary policy.

3. Data and Methodology

3.1 Data

This study adopted a quantitative research design. Secondary data was extracted from World Bank publications (data.worldbank.org) spanning from 1970 to 2021 based on data availability for the study variables and the purposive sampling technique was explored. The dependent variable is GDP proxied for Nigeria economy, independent variables are exchange rate and interest rate (monetary policy) while inflation is the control variable.

Table 1: Variable measurement

Variables	Unit measurement
GDP	Billion USD
Exchange rate	Naira Per Dollar
Interest rate	Percentage (%)
Inflation	Percentage (%)

***Source*:** World Bank

3.2 Methodology

The method of analysis applied are summary statistics (such as mean and standard deviation), regression model, unit root test and cointegration analysis.

3.2.1 Model specification

Empirically, the generalized model for this study can be written as follows:

GDP = F (interest rate, exchange rate, inflation)

3.3 Regression model

The regression model helps to predict a dependent variable (GDP) with one or more independent variables (interest rate and exchange rate while inflation is the control variable). It also helps to examine the impact of the independent variables on a dependent variable. Meanwhile, the dependent variable in a regression model is expected to be a continuous scale (ratio or interval) while the independent variables can either be continuous or categorical (nominal or ordinal).

Mathematically, the regression model for this study can be written as:

$$GDP_{(t)} = \beta_0 + \beta_1 INTR_{(t)} + \beta_2 EXCH_{(t)} + \beta_3 INF_{(t)} + \varepsilon_{(t)}$$

Where β_0 is the intercept or constant term, β_1 to β_3 are the coefficient estimate of the independent variables and $\varepsilon_{(t)}$ is the stochastic error term that takes care of the unaccounted factors. And t is the period in year.

3.4 Unit root test

If not eliminated, the unit root's presence indicates that the series is not stationary, which could lead to incorrect results. To rule out the chance of inaccurate results, the test is conducted. The following is a description of the unit root test of the hypothesis:

H_0: there is an existence of a unit root vs H_a: there is no unit root (the variable is stationary). The augmented dickey fuller (ADF) test can be presented mathematically as:

$$\Delta Y_t = \theta + \gamma Y_{t-1} + \sum_{i=1}^{p} \beta_i Y_{t-i} + \omega_t$$

Where, θ is a constant, γ is the coefficient of process root, β_i coefficient in time tendency, p is the lag order and ω_t is the stochastic (error) term.

3.5 Cointegration analysis

Johansen cointegration test is an approach for testing the cointegration of integrated variables with zero level me (0), order 1, or me (1) - after the first difference. This test permits more than one cointegrating relationship. There are two types of Johansen tests which are the trace and max eigenvalue, and they form the basis of the inference or decision and their result might be a little different from others.

It is important to note that the variables should be stationary before proceeding to the Johansen Cointegration test. When there is cointegration, it means there is a long-run association between the variables.

4. Result and discussion

This section of this paper will be presenting the result of the analysis and the discussion of notable findings.

4.1 Result

Table 2: Summary statistics

	GDP	Exchange rate	Interest rate	Inflation
Mean	165.6990	86.72792	-1.213977	18.17201
Median	71.46656	21.89065	1.398488	12.94180
Std. Dev.	168.1193	111.4822	13.96863	15.32529
Maximum	546.6764	472.4000	18.18000	72.83550
Minimum	9.181770	0.546781	-65.85715	3.457600
Observations	52	52	52	52

***Source*:** Author's computation using E views software

The table 1 show that mean of the Nigeria GDP is about 166 Billion USD with variability of about 168 Billion USD during the period under review. The Nigeria exchange rate on the average is about 87 Naira per Dollar with variability of about 111 Naira per dollar during the period under review. The Nigeria interest rate on average is about -1.2% with variability of about 14% which clearly indicate a poor performance in the monetary policy of the country. Meanwhile, the Nigeria inflation rate on the average is about 18% with variability of about 15% during the period under review.

Table 2: Regression model

GDP	Coefficient	Std. Error	t-Statistic	Prob.	VIF
C	85.21474	25.52287	3.338760	0.0016	NA
Exchange rate	1.193893	0.130074	9.178583	0.0000	1.156709
Interest rate	0.172913	1.131430	0.152827	0.0492	1.374031
Inflation	-1.257410	0.988096	-1.272558	0.0093	1.261389

R-squared	0.691274	Mean dependent var		165.6990	
Adjusted R-squared	0.671979	S.D. dependent var		168.1193	
Prob(F-statistic)	0.000000				

***Source*:** Author's computation using E Views software

From table 2. We can write out the regression model as:

$$GDP_{(t)} = 85.21 + 0.17INTR_{(t)} + 1.19EXCH_{(t)} - 1.26INF_{(t)}$$

From the regression model above, we can see that for 1% increase in Nigeria interest rate, GDP will increase by about 0.17 Billion USD. Similarly, for 1 Naira per dollar increase in Nigeria exchange rate, GDP will rise by about 1.19 Billion USD while for 1% increase in the Nigeria inflation rate, GDP will decline by about 1.26 Billion USD.

Table 2 also reveal that overall regression model ($p<0.05$) which means the fitted regression model is statistically significant at 5% level and this indicate that there is a significant linear relationship between GDP and monetary policy indicators such as exchange rate, interest rate while controlling for inflation rate. The coefficient of determination R-squared = 0.69 which implies that 69% variation in GDP can be explained by exchange rate, interest rate and inflation rate while the remaining 31% can be attributed to other factors not included in the model. Since the regression model is significant and the R-squared is relatively high, this suggest that the model is a good fit to the data and it is very suitable for future prediction of Nigeria GDP.

Besides, the regression model also show that the coefficient of exchange rate and interest rate have positive and significant impact on Nigeria GDP while the coefficient of the inflation rate has negative and significant impact on Nigeria GDP. Following the three stated hypotheses in this study:

H_1: The Inflation rate has a negative impact on GDP
H_2: The Exchange rate has a negative impact on GDP
H_3: The Interest rate has a positive impact on GDP

Hypothesis 1 and 3 are supported as the inflation rate is seen to have a negative significant impact on GDP and interest rate is seen to have a positive significant impact on GDP but the hypothesis 2 was not supported as exchange rate has positive significant impact on GDP as against the postulate negative impact on GDP. This is very consistent with the work of Alisha (2020) [14] who finds out that inflation rate has negative impact on GDP while interest rate has positive impact on GDP.

The variance inflation factor (VIF) for all the independent variables are less than 5 (VIF<5) which indicate that the model does not suffer from the problem of multicollinearity and this further established that the model is robust and reliable.

Table 3: Unit root test

Differenced variables	Test-statistic	p-value	Order
GDP	-5.09	0.0001	I (1)
Exchange rate	-6.46	0.0000	I (1)
Interest rate	-4.83	0.0003	I (1)
Inflation	-7.34	0.0000	I (1)

***Source*:** Author's computation using E Views software

Table 3 shows the unit root test result and we can see that all the variables of interest becomes stationary after the first difference as they are all statistically significant at 5% level. Therefore, further analysis like cointegration test can be conducted.

Table 4: Johansen cointegration result

Unrestricted Cointegration Rank Test (Trace)				
Hypothesized		**Trace**	**0.05**	
No. of CE(s)	Eigenvalue	Statistic	Critical Value	Prob.**
None *	0.371107	57.60231	47.85613	0.0047
At most 1 *	0.267913	34.41264	29.79707	0.0137
At most 2 *	0.237047	18.81987	15.49471	0.0152
At most 3 *	0.100430	5.291894	3.841466	0.0214
Trace test indicates 4 cointegrating eqn (s) at the 0.05 level				

***Source*:** Author's computation using E Views software

Table 4 shows that all the trace statistic are greater than the critical value and all the P-values of the cointegrating equations are statistically significant at 5% level and this suggest that there is cointegration among the variables of interest and this implies that there is a long-run association between GDP, monetary policy indicators (exchange rate and interest rate) and inflation rate.

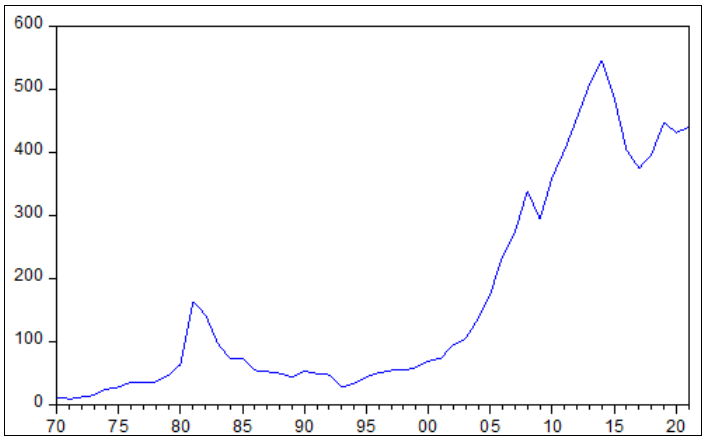

Fig 1: Graph of Nigeria GDP from 1970 to 2021

Figure 1 shows the fluctuation in the graph of Nigeria GDP from 1970 to 2021 being the period under review and we can see that Nigeria GDP drop from 448 Billion US dollars in 2019 t0 432 Billion US dollars in 2020 due to the effect of COVID-19 pandemic.

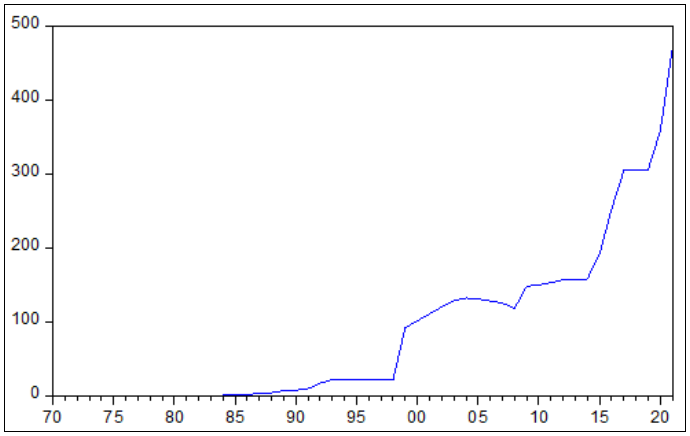

Fig 2: Graph of Nigeria Exchange rate from 1970 to 2021

Figure 2 shows the upward trend fluctuation pattern of the Nigeria exchange rate during the period under review and the graph show that Nigeria exchange rate rises with about 307 Naira per dollar in 2019 to about 359 Naira per dollar in 2020 and also increases to about 472 Naira per dollar in 2021. This also agree with the current situation in Nigeria today as the dollar rate at the parallel market is approaching 1000 Naira to a dollar.

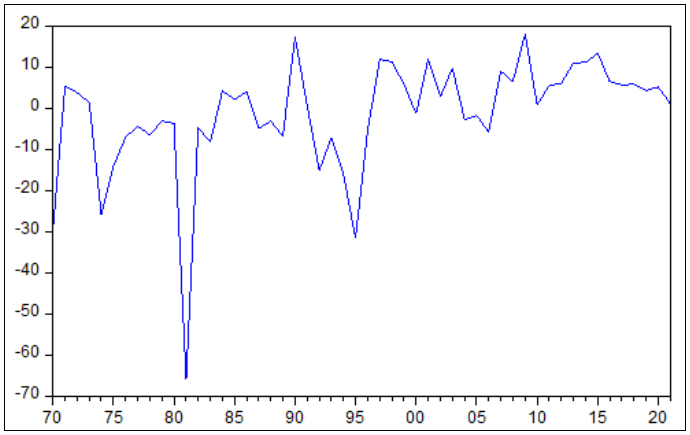

Fig 3: Graph of Nigeria Interest rate from 1970 to 2021

Figure 3 shows the fluctuation pattern in Nigeria interest rate plot during the period under review and we can see that Nigeria interest rate rises from about 4.5% in 2019 to about 5.4% in 2020 while declining to about 1.2% in 2021.

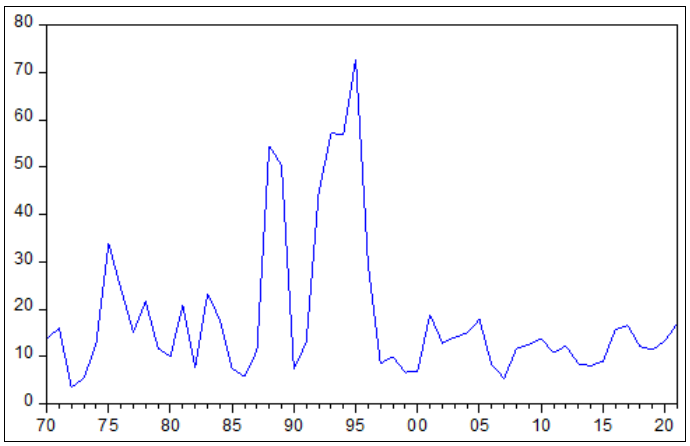

Fig 4: Graph of Nigeria Inflation rate from 1970 to 2021

Figure 4 shows the fluctuation in the pattern of the Nigeria exchange rate and the graph also reveal that inflation rate

rises from about 11.4% in 2019 to about 13.2% in 2020 and then increases to about 17% in 2021 which also agree with the situation on ground as there is hike in general price level of goods and services in Nigeria and this has also led to the country to recession.

4.2 Discussion of findings

Based on the results of the analysis of this study above, the following are the key findings that were deduced.

Figure 1 shows the fluctuation in the graph of Nigeria's GDP from 1970 to 2021 the period under review and we can see that Nigeria's GDP dropped from 448 Billion US dollars in 2019 to 432 Billion US dollars in 2020 due to the effect of a covid-19 pandemic. Figure 2 shows the upward trend fluctuation pattern of the Nigeria exchange rate during the period under review the graph shows that Nigeria's exchange rate rises from about 307 Naira per dollar in 2019 to about 359 Naira per dollar in 2020 and also increases to about 472 Naira per dollar in 2021. This also agrees with the current situation in Nigeria today as the dollar rate at the parallel market is approaching 1000 Naira to a dollar. Figure 3 shows the fluctuation pattern in Nigeria's interest rate plot during the period under review and we can see that Nigeria's interest rate rises from about 4.5% in 2019 to about 5.4% in 2020 while declining to about 1.2% in 2021. Figure 4 shows the fluctuation in the pattern of the Nigeria exchange rate and the graph also reveals that the inflation rate rises from about 11.4% in 2019 to about 13.2% in 2020 and then increases to about 17% in 2021 which also agrees with the situation on the ground as there is a hike in the general price level of goods and services in Nigeria and this has also led to the country to recession.

A regression model was applied and it indicates that there is a significant linear relationship between GDP and monetary policy such as exchange rate, and interest rate while controlling for the inflation rate. The coefficient of determination R-squared = 0.69 which implies that 69% of the variation in GDP can be explained by the exchange rate, interest rate and inflation rate while the remaining 31% can be attributed to other factors not included in the model. Besides, the regression model also shows that the coefficient of the exchange rate and the interest rate has a positive and significant impact on Nigeria's GDP while the coefficient of the inflation rate has a negative and significant impact on Nigeria's GDP. Based on the regression result, Hypothesis 1 and 3 are supported as the inflation rate is seen to have a negative significant impact on GDP and the interest rate is seen to have a positive significant impact on GDP but hypothesis 2 was not supported as the exchange rate has a positive significant impact on GDP as against the postulate negative impact on GDP. This is very consistent with the work of Alisha (2020) [14] who finds out that the inflation rate hurts GDP while the interest rate has a positive impact on GDP.

The unit root test was applied and all the variables are integrated of order one this gives room for further econometric analysis and this makes the Johansen cointegration test be adopted.

The Johansen cointegration analysis shows that there is cointegration among the variables of interest and this implies that there is a long-run association between GDP, monetary policy indicators (exchange rate and interest rate) and inflation rate which supports the work of Ehikioya (2019) [5], and Alagidede and Ibrahim (2017) [2].

5. Conclusion and policy implication

Redesigning the naira is also a good monetary policy, which is proxied by the interest rate and the exchange rate, to prevent naira counterfeiting and control the amount of currency in circulation to reduce inflation.

This study's sole purpose is to examine the effect of the Naira redesign and monetary policy on the Nigerian economy. The regression model demonstrates a significant relationship between GDP and monetary policy while controlling for the inflation rate. Furthermore, the model demonstrates that the exchange rate and interest rate coefficients have a positive and significant impact on Nigeria's GDP, whereas the inflation rate coefficient has a negative and significant impact on Nigeria's GDP. The Johansen cointegration analysis reveals a long-term relationship between the GDP, exchange rate, interest rate, and inflation. This suggests that, if properly implemented by the federal government through the central bank of Nigeria, monetary policy has a positive, significant effect on the Nigerian economy.

Therefore, the government should strictly implement the Naira redesign decision via the Nigerian central bank periodically to prevent the counterfeiting of Naira notes, withdraw approximately 80% of Naira currency held outside of commercial banks, and reduce the inflation rate that has led Nigeria to the recession, which will have a positive effect on the Nigerian economy.

6. References

1. Adeniran JO, Yusuf SA, Adeyemi AO. The Impact of Exchange Rate Fluctuation on the Nigerian Economic Growth: An Empirical Investigation. International Journal of Academic Research in Business and Social Sciences. 2014;4(8):224-233.
2. Alagidede, Paul, Muazu Ibrahim. On the Causes and Effects of Exchange Rate Volatility on Economic Growth: Evidence from Ghana. International Growth Center Working Paper. London: London School of Economic and Political Science; c2017.
3. Alasha RU. The impact of exchange rate fluctuations on economic growth in Nigeria. Department of Economics, Faculty of management and Social Science, Baze University, Abuja. Project Paper; c2020.
4. Balcilar, Mehmet, Ojonugwa Usman, and Esther Abdul Agbede. Revisiting the Exchange Rate Pass-Through to Inflation in Africa’s Two Largest Economies: Nigeria and South Africa. African Development Review. 2019;31:245-57.
5. Ehikioya, Benjamin Ighodalo. The impact of exchange rate volatility on the Nigerian economic growth: An empirical investigation. Journal of Economics & Management. 2019;37:45-68.
6. Emefiele G, Buhari M. The governor of the central bank of Nigeria announces the Naira redesign decision following the approval of president Mohammadu Buhari for the Apex bank to proceed with the Naira redesign; c2022. https://www.thisdaylive.com/index.php/2022/10/31/president-cbn-has-my-backing-to-redesign-naira-notes/.

7. Loan, Batrancea, Rathnaswamy Malar Mozi, Gaban Lucian, Fatacean Gheorghe, Tulai Horia, Bircea Ioan, *et al*. An Empirical Investigation on Determinants of Sustainable Economic Growth. Lessons from Central and Eastern European Countries. Journal of Risk and Financial Management. 2020;13:146.
8. Mahonye, Nyasha, Tatenda Zengeni. Exchange rate impact on output and inflation: A historical perspective from Zimbabwe. African Journal of Science, Technology, Innovation and Development. 2019;11:347-58.
9. McKay A, E Nakamura, J Steinsson. The power of forward guidance revisited, American Economic Review. 2016;106(3133–58):1.
10. Morina, Fatbardha, Eglantina Hysa, Ugur Ergün, Mirela Panait, Marian Catalin Voica. The Effect of Exchange Rate Volatility on Economic Growth: Case of the CEE Countries. Journal of Risk and Financial Management. 2020;14:1344.
11. Munthali, Thomas, Kisu Simwaka, Macdonald Mwale. The real exchange rate and growth in Malawi: Exploring the transmission route. Journal of Development and Agricultural Economics. 2010;2:303-15.
12. CBN. Central bank of Nigeria announced her decision in redesigning Naira to prevent counterfeiting; c2022. https://punchng.com/cbn-plans-naira-redesign-to-counter-counterfeiting-kidnapping/#:~:text=The%20Governor%2C%20the%20Central%20Bank,gave%20reasons%20for%20the%20move.
13. Roger, Lionel, Gregory Smith, Oliver Morrissey. Exchange Rate and Inflation Dynamics in a Resource Rich Setting: The Case of Zambia. South African Journal of Economics. 2019;87:490-514.
14. Alisha F, Davlasheridze M, Mykoniatis N. Socioeconomic drivers of marine debris in North America. Marine Environmental Research. 2020 Sep 1; 160:105042.