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Effect of exchange rate fluctuation on external reserve in Nigeria

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Abstract: *This study examines the relationship between exchange rate fluctuations and external reserves in Nigeria, focusing on the inflation rate, interest rate, and public debt as independent variables. It aims to analyze how these factors collectively influence external reserve management, with specific objectives involving the impact of the inflation rate, the influence of interest rate, and the effects of public debt. Using a causal research design and time series data from 2001 to 2021, sourced from the Central Bank of Nigeria Statistical Bulletin, Eviews 12 facilitates analysis. using ordinary least square Method, Descriptive statistics, regression analysis, and diagnostic tests like the Breusch-Godfrey Serial Correlation LM Test and Heteroscedasticity Test provide insights into external reserves, inflation rate, interest rate, and public debt characteristics. Findings reveal a negative relationship between external reserves and the independent variables, emphasizing the roles of inflation rate, interest rate, and public debt. Regression analysis confirms statistical significance, except for public debt. The R2 value of 0.542050 suggests that 54% of external reserve changes are explained by the selected variables. Diagnostic tests confirm model reliability, holding implications for policymakers and stakeholders in understanding factors influencing external reserve management. In conclusion, the study underscores the critical importance of sound macroeconomic policies in managing Nigeria's external reserves. Negative relationships observed emphasize the need for strategic interventions. Recommendations include maintaining price stability, optimizing interest rate policies, practicing prudent debt management, diversifying funding sources, serving as a guide for policymakers to navigate economic challenges, and enhancing Nigeria's external reserves' resilience.*

Keywords*: External reserve; External reserve management; Inflation rate; Interest rate; Public debt; Exchange rate.*

1. Introduction

Adequate holding of foreign (otherwise external) reserves is very important to a country because it assists in withstanding unexpected monetary shocks. It provides cushions to pressing economic problems; it intervenes when exchange rate is volatile; and it boosts an economy's creditworthiness and access to international market. Adequate foreign reserve is a buffer when nations experience drops in revenue and would need to fall back on its savings as a lifeline and a means to meet timely international payment obligations. Payments for trade between countries are done with foreign currencies therefore, it is mandatory to ensure that adequate reserves are always available (CBN, 2007).

There is no country in the world that will allow its currency to float in the foreign exchange market without an adequate intervention. The monetary authorities attempt to influence their countries' exchange rates by buying and selling currencies in order to manage their country exchange rate. The reason being that the currency rates impact any given country's economy through the trade balance (capital and current transaction account) and this automatically determine the value and quantity of exchange reserves holdings of a country. From this perspective, almost all currencies are managed since central banks or governments intervene to influence the value of their currencies. According to the International Monetary Fund (2009), 82 countries and regions used a managed float, or 43% of all countries, constituting a plurality amongst exchange rate regime.

In view of the above, management of external reserve stands as one of the integral core functions of Central Bank of any nation including Nigeria. It involves maintaining an adequate volume of reserve in order to safeguard the value and exchange rate of the domestic currency. Adequate holdings of external reserves which are mostly denominated in foreign currencies such as Dollar, Pounds, Yen, Euro, Gold, Precious Stones, Foreign Treasury Bills, IMF funds, SDR rights etc. are very important to a country. It tends to assist the country to withstand shock which might set in unknowingly or as a cushion effect when an economy is faced with pressing economic problems, intervention when the exchange rate is volatile or to boost a country credit worthiness when access to international market is difficult or impossible.

Interest rate being a short-term monetary policy tool is used by the monetary authority of a country to influence the level of foreign reserves of a nation (Bird & Rajan, 2003). Higher interest rates increase the value of a given economy’s currency. An interest rate above the average world rate will attract foreign capital into the domestic market, and as this continuous, the value of the country’s currency increases. Conversely, lower interest rates tend to be unattractive for foreign investment and it also decreases the value of a country’s currency. Interest rate decisions in Nigeria are taken and reported by the Central Bank (CBN, 2015).

Nigeria has consequently been engaging in deficit spending as anchor to capital formation and sustainable output growth. Plethora of studies has established that internal or external debt, when applied wholly on public works and infrastructure has the capacity to stimulate the economic wellbeing of a nation (Asogwa et al., 2018). According to Soludo (2013) public debt is needed to elevate and spur the size of aggregate investment and circumvent funding constraints of government budget in order cultivate sustainable growth and the GDP per capita of the nation. Records show that the fall in commodity prices in 1978 pressured the federal government to borrow from overseas (external debt) due to its dwindling foreign exchange earnings from crude oil to meet her many public works and projects in order to better the lots of the people (Rahaj, 2018).

The broad objective of this study is to examine the effect of exchange rate fluctuation on external reserve in Nigeria, the specific objectives of the study are to determine the effect of inflation rate on external reserve of Nigeria, investigate how interest rate affect external reserve of Nigeria, examine the effect of public debt on external reserve of Nigeria. The hypotheses of this

study states that Inflation rate has no significant effect on external reserve of Nigeria, interest rate does not significantly affect external reserve of Nigeria, Public debt has no significant effect on external reserve of Nigeria.

Having introduced the paper, the next section is on review of related literature. Section three is on the method adopted for the study. Section four contains the interpretations of results while section five concludes the paper.

2. Literature review

External reserves, also known as International reserves, foreign reserves or foreign exchange reserves, have been defined by the International Monetary Fund's (2009) as 'those external assets that are readily available to and controlled by monetary authorities for meeting balance of payments financing needs, for intervention in foreign exchange markets, to affect the currency exchange rate, and for other related purposes (such as maintaining confidence in the currency and the economy, and serving as a basis for foreign borrowing)'. Obaseki (2007) defines it to include gold and or other central bank's assets, which come entirely within its control and are easy to trade on international financial markets'. External Reserves are variously called International Reserves, Foreign Reserves or Foreign Exchange Reserves (Osuji & Ebiringa, 2012

Managing External Reserves is one of the core mandates of the Central Bank of Nigeria (CBN) as stipulated in Section 2 (c) of the CBN Act of 2007. The Act vested the maintenance and management of Nigeria's external reserves on the CBN in order to safeguard the international value of the Naira. In addition, it is to maintain confidence in Nigeria's monetary and exchange rate policies, as well as provide confidence to the international community that the country is able to meet its external obligations. The CBN through interventions in the foreign exchange market supports monetary policy implementation by maintaining exchange rate stability and liquidity management.

Foreign Reserves in Nigeria Foreign reserves were primarily made up of gold and, on occasion, silver when the bank was established. However, following WWII, the Bretton Woods System established the US Dollar as a reserve currency, allowing it to be included in any country's official international reserves. The Federal Reserve System made it easy to exchange the US Dollar into gold from 1944 until 1968. However, no central bank was able to convert US dollars to gold from official gold reserves after 1968. No organization or individual was able to convert US Dollars into gold from government gold reserves for several years after 1973. Since 1973, no major currencies have been able to convert their reserves of gold into gold. Institutions and individuals must now purchase gold on private markets in the same way they would other commodities According to Bergen (2017), the following factors determine a country's exchange rate which includes differentials in inflation, differentials in interest rates, current account deficits and public debts.

Interest rate is a return to fund-owners or the cost of borrowing. It is usually expressed as a per cent per annum of the amount of money invested, lent or borrowed (Reserve Bank of Australia, 2012). There are various types of interest rates based on policy, deposit and lending rates (CBN, 2016). The deposit rates are paid on savings and time deposits of different maturities such as a one-month and fixed deposit in financial institutions; and lending rates are charged by money lenders for meeting the short and medium-term financing needs of borrowers. The monetary policy rate (MPR) is the rate at which CBN lends to deposit money banks (DMBs) in performing their duties as lenders of last resort. It is usually set at a level that.

A nation's debt ranking is an important aspect of its exchange rate. Countries partake in huge-scale deficit financing to execute national infrastructure and support government funding. Although such activities help stimulate the home economy, countries with huge government debts are less appealing to outside shareholders. A huge public obligation could bring about expansion. External debt could be a reproductive stimulant in a well cultured system with fiscal discipline; however, this is yet to be seen in Nigeria owing to fiscal indiscipline and financial corruption. Consequently, the twin attacks on the international reserves of the nation via concomitant debt servicing and foreign exchange for importation stand to drain the reserves without a corresponding increase in earnings. Further to this, economic theory holds that increasing external debt exposes a nation to high risk and that increasing foreign exchange reserves reduces the exposure level of a nation (Mansour, 2013).

Oligbi and Iyoha (2020) estimated the demand for international reserves function in Nigeria using the vector auto-regressive model and annual time-series data for 1980-2017. The result indicated that there is a stable, long-run relationship between international reserves and domestic interest rate among other variables though other types of interest rates were not investigated. Oyeniran and Alamu (2020) determined the optimal levels of foreign reserves in Nigeria. The study adopted the buffer stock model as advanced by Frenkel and Jovanovic (1981) using the autoregressive distributed lag approach (ARDL). The results showed that Nigeria's optimal reserves level responded positively to opportunity cost of reserves holding, adjustment cost of holding reserves, and exchange rate volatility though the various types of interest rates were not investigated.

Pina (2017) examined the relationship between international reserves and global interest rate using a simple open economy model. The study used quarterly data for 75 countries between the periods from 2000 and 2013. The result showed that change in global interest rate was positively related to the target level of external reserves. Azar & Wael (2017) did a panel study on the accumulation of foreign exchange reserves and the development of the macro-economy in the Gulf and Cooperation Council (GCC) countries including Bahrain, Kuwait, Oman, Qatar, Saudi Arabia and the United Arab Emirates from 1996 to 2015 using the ARDL model. The empirical results showed that the stockpile of foreign exchange reserves in the GCC countries was not significant to interest rates on the US dollar, neither to nominal effective exchange rates nor to the ratio of imports to GDP.

2.1. The monetary model of exchange rates

This hypothesis suggests that trade rates are settled amid the way toward changing the stock or total interest and supply of cash in each nation. As indicated by the fiscal methodology, the ostensible interest for cash is reliable over the long haul and furthermore emphatically identified with the dimension of ostensible national salary yet conversely identified with financing cost. The country's cash supply is equivalent to its money related base occasions the multiplier factor. The country's money related base is equivalent to the residential credit built up by its financial experts in addition to its universal hold. Except if satisfied locally, an abundance supply of cash in the country results in a surge of stores, or an equalization of installment shortage under settled trade rates and a deterioration of the country's money (with no universal stream of stores) under the adaptable conversion standard. The contrary gets put with an abundance interest for money in the country.

3. Methods

The research design adopted in this study is causal research design. Time series annual data on inflation rate, interest rate, public debt in Nigeria were extracted from Central Bank of Nigeria Statistical Bulletin. This section presents the ssources of data, method of data analysis, description of research variables, model specification and estimation techniques. It also contains a detailed outline of system of modelling equations that were used to achieve the objectives of the study.

3.1. Model specification

In this research, the type of data analysis that will be employed is the inferential statistics (i.e parametric statistics), such as regression analyses. To achieve the objectives of this study, the study adopted the model in Eq.(1).

$$ERM = a + \alpha 1IFR + \alpha 2ITR + \alpha 3PD + e \quad (1)$$

Where:

ER = External reserve
IFR = Inflation rate
ITR = Interest rate
PD = Public debt
a = Constant;
αi- α3 = Regression Coefficients;
e= Error term

3.1.1. Dependent Variable

External reserve: These are assets held on reserve by a monetary authority in foreign currencies. These reserves are used to back liabilities and influence monetary policy. They include foreign banknotes, deposits, bonds, treasury bills and other foreign government securities. These assets serve many purposes but are most significantly held to ensure that a government or its agency has backup funds if their national currency rapidly devalues. Foreign exchange reserves are also called international or external reserves.

3.1.2. Independent Variables

Inflation rate: Inflation is the rate of increase in prices over a given period of time. Inflation is typically a broad measure, such as the overall increase in prices or the increase in the cost of living in a country.

Interest rate: The interest rate is the amount a lender charges a borrower and is a percentage of the principal—the amount loaned. The interest rate on a loan is typically noted on an annual basis known as the annual percentage rate (APR).

Public debt: Public debt is the amount of money owed by a government to its creditors, including individuals, corporations, and other governments. Public debt is one way for a government to get extra funds for economic development. Public debt can lead to severe economic problems when not properly managed

4. Results

4.1. Descriptive Statistics

The study examines the effect of exchange rate fluctuation on external reserve in Nigeria from 2001 to 2021. The study carried out a multiple regression method of estimation. The statistical package Eviews 12 was used to conduct all the various analyses and tests. The first step adopted was to analyze the descriptive survey of the variables after which regression analysis was carried out using ordinary least square Method. Also, diagnostic test such as serial correlation LM test and heteroskedasticity were conducted. Table 1 shows the summary statistics of the variables used in Model of the study which includes external reserves, inflation rate, interest rate and public debt.

Table 1 - Summary statistics of the variables used in Model

	External reserve	**Inflation rate**	**Interest rate**	**Public Debt**
Mean	361401.3	12.60095	17.28451	10759.20
Median	401374.5	12.56000	16.93750	6519.690
Maximum	650682.2	18.8/000	24.85000	35097.79
Minimum	86236.88	5.390000	11.55463	2204.122
Std. Dev.	151598.3	3.520335	2.735313	9269.888
Skewness	-0.462780	-0.111490	0.415813	1.310581
Kurtosis	2.569104	2.390697	4.851796	3.666546
Jarque-Bera	0.912039	0.368350	3.605658	6.400429
Probability	0.633801	0.831790	0.164832	0.040/53
Sum	7589426.	264.6200	362.9748	225943.3
Sum Sq. Dev.	4.60E+11	247.8552	149.6388	1.72E+09
Observations	21	21	21	21

The result shows that the mean value of external reserves is the highest at 36.14013, while public debt has the lowest mean value at 10.75920. The result also shows that all the variable in the study have positive median values. External reserves possess the highest maximum value of 65.06822 while the value of inflation rate has the lowest minimum value of 18.87000. Public debt has the highest standard deviation with a value of 9.269888, while external reserves have the least standard deviation with a value of 1.515983. Both interest rate and public debt have positive skewness which implies that the mass of the distribution is concentrated on the left, while external reserves and inflation rate have negative skewness. This means that the distribution is concentrated to the right. External reserves and inflation rate show kurtosis which is less than 3, meaning they are platykurtic and they have fewer extreme outliers than the normal distribution. However, interest rate and public debt have kurtosis of 4.851796 and 3.666546 respectively which is greater than 3, hence it is leptokurtic. The Jarque- Bera test also shows that all the variables except interest rate and public debt are normally distributed as their probability values are greater than 0.05 at 5% level of significance.

Table 2 presents the regression analysis of Model. The result shows that there is a negative relationship between external reserves (dependent variable) and inflation rate, interest rate and public debt (independent variables).

Table 2 - Result of the Regression Analysis

Variable	Coefficient	Std. Error	t-Statistic	Prob.
INFLATION_RATE	-20740.84	7533.296	-2.753222	0.0136
INTEREST_RATE	-30334.16	11511.20	-2.635186	0.0174
PUBLIC_DEBT	-0.627550	3.507289	-0.178927	0.8601
C	1153819.	219372.7	5.259628	0.0001

R-squared	0.542050	Mean dependent var	361401.3
Adjusted R-squared	0.461235	S.D. dependent var	151598.3
S.E. of regression	111274.0	Akaike info criterion	26.24702
Sum squared resid	2.10E+11	Schwarz criterion	26.44598
Log likelihood	-271.5937	Hannan-Quinn criter.	26.29020
F-statistic	6.707312	Durbin-Watson stat	1.127591
Prob(F-statistic)	0.003450		

Dependent Variable: EXTERNAL_RESERVES
Method: Least Squares
Date: 06/03/23 Time: 07:35
Sample: 2001 2021
Included observations: 21

Source: Author's computation using Eviews 12 (2023)

However, despite all possessing negative relationships with external reserves, the relationship is significant in relation to external reserves except public debt which is insignificant. The R^2 is 0.542050, which implies that about 54% of the changes in external reserves is as a result of changes in the independent variables (i.e. inflation rate, interest rate and public debt) in the model, while 48% is caused by factors not included in the model. Also, the result indicates that the Durbin Watson is 1.127597, which means that there is a small successive error difference which indicates the presence of autocorrelation. The result of the F-stat shows that the variables are jointly significant in explaining external reserves at 5% significant level.

4.1.1. Diagnostic Tests

Table 3 reported p-value of 0.0619 was greater than the critical level of significance at 0.05. This implies that the model if free from the problem of serial correlation.

Table 3 - Breusch-Godfrey Serial Correlation LM Test

Breusch-Godfrey Serial Correlation LM Test:
Null hypothesis: No serial correlation at up to 2 lags

F-statistic	3.369473	Prob. F(2,15)	0.0619
Obs*R-squared	6.509877	Prob. Chi-Square(2)	0.0386

Source: Author's computation using Eviews 12 (2023)

The study given that the reported p-value of 0.9319 was greater than the critical level of significance at 0.05. This indicates that the model if free from the problem of heteroscedasticity.

Table 4 - Heteroschedasticity Test

Heteroskedasticity Test: Breusch-Pagan-Godfrey
Null hypothesis: Homoskedasticity

F-statistic	0.144371	Prob. F(3,17)	0.9319
Obs*R-squared	0.521731	Prob. Chi-Square(3)	0.9141
Scaled explained SS	0.243078	Prob. Chi-Square(3)	0.9704

Source: Author's computation using Eviews 12 (2023)

5. Conclusion

In conclusion, the study has provided valuable insights into the relationship between exchange rate fluctuation and external reserves in Nigeria. The negative relationships observed with inflation rate, interest rate, and public debt underscore the importance of sound macroeconomic policies. Policymakers should consider these recommendations to enhance the management of external reserves and ensure economic stability in the face of exchange rate fluctuations.

These recommendations aim to provide a basis for policymakers and relevant stakeholders to formulate strategies that can positively influence the external reserve position of Nigeria. Adjustments and implementations should be carried out with careful consideration of the dynamic economic conditions and in collaboration with key stakeholders.

5.1. Recommendations

The findings indicate that the negative relationship between external reserves and inflation rate suggests that efforts should be directed towards maintaining price stability. The central bank should consider adopting and implementing effective monetary policies to control inflation and ensure the stability of external reserves. Government fiscal policies should focus on maintaining fiscal discipline to curb inflationary pressures. Responsible fiscal management can contribute to a stable economic environment and, in turn, positively impact external reserves.

The negative relationship between interest rates and external reserves implies that adjustments in interest rates can influence the external reserve levels. Policymakers should carefully consider interest rate policies to strike a balance between promoting economic growth and maintaining external reserve stability. Monitor global economic conditions: Given the sensitivity of external reserves to interest rate fluctuations, it is crucial to stay informed about global economic conditions. Timely adjustments to interest rates in response to international economic developments can help mitigate the impact on external reserves.

While public debt did not show a significant relationship with external reserves, it is essential to maintain a sustainable level of public debt. Prudent debt management practices can prevent excessive reliance on borrowing and contribute to overall economic stability. Explore alternative sources of funding to reduce dependence on debt financing. Diversifying funding

sources, such as through public-private partnerships or foreign direct investment, can contribute to a more stable economic environment and lessen the impact on external reserves. The study also recommends that, the fiscal managers of Nigeria should exercise cushion in external borrowing in order to ensure that spiraling external debt service payments does not deplete the external reserves of the country.

Finally, the government should influence the foreign exchange rate, by positive economic reforms that will reduce the adverse effect of unstable foreign exchange rate on the Nigerian economy with respect to external reserve.

References

Asogwa, J.O., U.L. Onyekwelu and E. Okechukwu, 2018. Evaluation of the effect of federal government external debts and reserves on economic growth in Nigeria. *Journal of Economics and Sustainable Development*, 9(6): 34-44.

Azar, S. A and Wael-Aboukhodor, W. (2017). Foreign exchange reserves and the macroeconomy in the GCC Countries. Accounting and Finance Research, 6(3), 45–60.

Bergen, T.V. (2017). 6 Factors that influence exchange rates. Retrieved from: http: www. Investopia.com/article/basics/04/050701.asp .

Bird, G & Rajan, R (2003) Too much of a good thing? The adequacy of international reserves in the aftermath of crises. *Center for International Economic Studies Journal*

CBN (2007). Building and managing external reserves for economic development. The CBN Bullion. 31(2):24-36

CBN (2015). Optimal foreign exchange reserves in |Nigeria. Central Bank of Nigeria.

CBN (2016). Interest rate. Education in economics Series No. 3. Central Bank of Nigeria Publication.

Frenkel, J.A., & Jovanovic, B. (1981). On transactions and precautionary demand for money. NBER Working Papers 0288, National Bureau of Economic Research, Inc.

International Monetary Fund. (2009). International Monetary Fund, Annual Report. Retrieved from www.imf.org/external/pubs/ft/ar/2009/eng/pdf/a1.pdf

International Monetary Fund. (2011). BPM6 Compiltion Guide. Washington DC, USA: International Monetary Fund, Publication Services

Mansour, L., (2013). International reserves versus external debts: Can international reserves avoid future financial crisis in indebted countries? GATE. Lyon: L'archive ouverte pluridisciplinaire HAL. pp: 1-32

Obaseki, P.J. (2007), Foreign Exchange Management in Nigeria. Past, Present and Future. CBN Economic and Financial Review. Vol. 29, No. 1.

Oligbi, B. O. and Iyoha, M. A. (2020). Estimating the demand for international reserves function in Nigeria: Evidence from vector autoregression. *International Journal of Research and Innovation in Social Science* (IJRISS), 5(2), 46–62.

Osuji C. C. & Ebiringa O. T. (2012). Analysis of effect of external reserves management on macroeconomic stability of Nigeria. Int. J. Bus. Manage. Econ. Res. 3(6):646-654.

Oyeniran, I. W. and Alamu, S. A. (2020). Determination of optimal Level of foreign reserves in Nigeria. *CBN Journal of Applied Statistics* 11(1), 65–85.

Pina, G. (2017). International reserves and global interest rate. *Journal of International Money and Finance*, 74(2), 10–25.

Rahaj, A.R., 2018. External debt and economic growth in Nigeria: An ARDL approach. Audoe, 14(4): 581-596.

Reserve Bank of Australia (2012). Glossary. Retrieved on 4/10/2020 from https://www.rba.gov.au/glossary/

Soludo, C.C., 2013. The impact of external debt on economic growth: A comparative study of Nigeria and South Africa. *Journal of Sustainable Development in Africa*, 10(3): 55 – 59.

Appendix - DATA FOR THE STUDY

Year	External reserves(US$'M)	Inflation rate (%)	Interest rate (%)	Public debt (N'B)
2001	115,063.73	18.87	18.29	4,193.26
2002	97,424.98	12.88	24.85	5,098.88
2003	86,236.88	14.03	20.71	5,808.01
2004	129,802.04	15.00	19.18	6,260.60
2005	265,575.25	17.86	17.95	4,220.98
2006	409,180.95	8.23	17.26	2,204.72
2007	495,405.53	5.39	16.94	2,608.53
2008	650,682.24	11.58	15.14	2,843.56
2009	496,054.70	12.56	18.99	3,818.47
2010	417,939.21	13.72	17.59	5,241.66
2011	360,334.57	10.84	16.02	6,519.69
2012	415,287.51	12.22	16.79	7,564.44
2013	506,521.13	8.48	16.72	8,506.31
2014	414,416.46	8.06	16.55	9,535.53
2015	331,395.98	9.01	16.85	10,948.51
2016	287,677.85	15.68	16.87	14,537.12
2017	349,377.00	16.52	17.56	18,377.00
2018	493,723.96	12.09	19.33	20,533.64
2019	470,915.03	11.40	15.53	23,295.06
2020	395,036.77	13.25	12.32	28,729.51
2021	401,374.55	16.95	11.55	35,097.79