

The Relationship between Exchange Rate Volatility and Monetary Policy Shocks in Nigeria.

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Abstract

The aim of this study is to examine the relationship between exchange rate volatility and monetary policy shocks in Nigeria. The results of past empirical studies have not shown a clear direction about the nature of relationship between these variables in the country and these studies have failed to utilize the methodology adopted in this work, which has created a gap in the literature. Data was collected from the Central Bank of Nigeria Statistical Bulletin from 1981– 2018 and various diagnostic tests such as Unit Roots and Johansen Co-integration test were carried out. Consequently, Vector Error Correction Mechanism (VECM) was utilized to address the objective of this study. From the results of this work, it was discovered that credit reserve requirement has a negative relationship with exchange rate. However, broad money supply, interest rate and inflation rate have a positive relationship with exchange rate in the country. Furthermore, due to these important findings, this paper makes the following vital policy recommendations for the monetary authorities, policy makers, financial institutions regulators and future researchers. Due to the high volatility in exchange rate in Nigeria currently, the monetary authorities should increase the credit reserve requirement of the commercial banks. Also, the Central bank should increase interest rate to the commercial banks. The multiplier effect of this policy will reduce the level of high powered money and consequently stabilize the exchange rate.

Keywords: Monetary Policy, Exchange Rate, Real and Normal rate

1.0 Introduction

Monetary policy in Nigeria is anchored on monetary targeting framework, such as exchange rate stability, full employment, and sustainable economic growth, balance of payment equilibrium and price stability which represents the overall objective of monetary policy. The special reference to price stability in this study is derived from new developments in monetary theories and empirical evidences which show that sustainable growth can only be achieved when there is stability in the price level (Nnanna, 2002). Therefore, the centrality of exchange rate in the formulation of monetary policy derives from the fact that for most countries, the prevailing objective of monetary policy is price stability. Volatility in exchange rate is always seen to be counter-productive to the objective of price stability. There is indeed, a general agreement that domestic price volatility undermines the value of money as a store of value, and frustrates investments and growth.

There is a widespread belief that volatility on the exchange rates less developed countries is one of the main sources of economic instability around the world. The impact of the global economy on emerging countries like Nigeria is driven significantly by swings among the currencies of the major economic powers like United State. In recent years these swings have been enormous, volatile and frequently unrelated to underlying economic fundamentals. This has encouraged monetary authorities in developing countries that keep close ties with the

economic powers to intervene on totally ad hoc and episodic basis, without any clear sense of a sustainable equilibrium. Such exchange rate stability intervention typically comes too late to prevent severe currency misalignment and volatility. These imbalances, in turn, trigger major economic distortions, protectionist trade pressures, and inevitably sharp currency reversals (Philippe et al., 2006).

Exchange rate regime varies with the level of financial development. Throughout the developing nations, the choice of exchange rate regime stands as perhaps the most contentious aspect of macroeconomic policy. Empirical literatures have shown that exchange rate volatility in turn is caused by both real and financial aggregate shocks. Yet, despite the perceived implications of the exchange rate regime to long-run growth and economic stability, the existing theoretical and empirical literature on Africa mostly Nigeria in particular considering the level of the country's economic integration through trade and foreign capital inflows offers little guidance. The theoretical literature is mainly tailored to richer countries with highly developed institutions and markets (e.g., (Garber et al., 1995; Obstfeld and Kenneth, 1996), and there is almost no discussion of long-run growth. The most known theoretical explanation of long-term stability and consistency of bilateral exchange rate is Purchasing Power Parity (PPP) hypothesis. Testing for long-run PPP is important for number of reasons: many monetary models á lá (Dornbusch, 1986), hinges on the validity of long-run PPP theory, while many other macroeconomic models often use PPP to link domestic and foreign development especially in developing countries like Nigeria.

In Nigeria, maintaining a realistic exchange rate for the naira is very crucial, given the structure of current economic situation, and the need to minimize distortions in production and consumption, increase the inflow of non-oil export receipts and attract foreign direct investment. Moreover, the persisting problems of import dependency, capital flight, and lack of motivation for backward linkages in the production process need to be addressed, amongst others. Exchange rate and monetary policy are therefore key tools in economic management and in the stabilization and adjustment policies in developing countries like Nigeria. In most developing countries, low inflation and international competitiveness have become major policy targets. The real exchange rate is a measure of international competitiveness.

Against this backdrop, this study tries examines the interplay between monetary policy shocks and exchange rate volatility in an import dependent economy like Nigeria. The rest of the paper is organized as follows; in addition to the introductory aspect, the section two addresses relevant theoretical and empirical literature review. Meanwhile, section three presents methodology, empirical results and policy recommendation.

2.0 Review of Relevant Literature

This section presents a review of literatures to put the study in context. The review covers conceptual framework as well as both theoretical framework and empirical literature.

2.1 Conceptual Framework

2.1.1 Concept of Monetary Policy

Monetary policy is defined as “any policy measure designed by the Federal Government through the CBN to control cost availability and supply of credit (CBN, 2009). Monetary policy deals with discretionary control of money supply by the monetary authorities (Central Bank with Central Government) in other to achieve stated or desired economic goals. Governments try to control the money supply because most governments believe that its rate of growth has an effect on the rate of inflation. Hence monetary policy comprises those government actions designed to influence the behaviour of the monetary sector. Jhingan (2008) defined it as the

use of money supply to regulate the level of economic activities in a country. Monetary policy is essentially a programme of action undertaken by the monetary authorities generally the central bank, to control and regulate the supply of money with the public and the flow of credit with a view to achieving predetermined macroeconomic goals (Dwivedi, 2005). Monetary policy consists of a Government's formal efforts to manage the money in its economy in order to realize specific economic goals.

If there is shortage of money supply in an economy, the monetary authority will embark on expansionary monetary policy so as to stimulate the level of economic activities and if there is excess money in circulation leading to increasing prices, the monetary authority will reduce the level of money supply using the various instruments of money control. Monetary Policy is the deliberate use of monetary instruments (direct and indirect) at the disposal of monetary authorities such as central bank in order to achieve macroeconomic stability. Monetary Policy is essentially the tool for executing the mandate of monetary and price stability.

Concisely, monetary policy objective of controlling money supply in the economy of a nation is to stimulate and achieve a desirable economic growth. Monetary policies are more effective only when economies are characterized by well-developed money and financial markets like developed economies of the world. This is where a deliberate change in monetary variable influences the movement of many other variables in the monetary sector.

Three basic kinds of monetary policy decisions can be made:

- a) The amount of money in circulation;
- b) The level of interest rate
- c) The functions of credit markets and the banking system (Ogunjimi, 1997).

The combination of these measures is designed to regulate the value, supply and cost of money in an economy, in line with the level of economic activity. Excess supply of money will result in an excess demand for goods and services, prices will rise and balance of payments will deteriorate. The challenges of monetary policy management rest wholly on monetary authorities which have over the years been committed to its effective control.

The instruments of monetary policies are divided into two: first, quantitative, general or indirect monetary policy and second, qualitative, selective or direct monetary policy. The indirect tools are related to the quantity or volume of the money. They are the general tools for credit control. They are designed to regulate or control the total volume of bank credit in the economy. I.e. they affect the level of aggregate demand through money supply, cost of credit and availability of credit.

2.1.2 Concept of Exchange Rate

Exchange rate is the rate at which one country's currency is exchanged for the currency of another country (Dornbusch, 2004). It can also be defined as the price of one country's currency relative to other countries' currency. While, Mankiw (1997) defines it as the price at which exchange between two countries take place. How to determine the exchange rate is issue that has taken the centre stage of monetary and international economics. Monetary policy authority in Nigeria is faced with the problems of having a stable and realistic exchange rate which is in consonance with other macroeconomic fundamentals. This is because exchange rate instability can have serious adverse consequences on prices, investments and international trade decisions. A realistic exchange rate is one that reflects the strength of foreign exchange inflow and outflow, the stock of reserves as well as ensuring equilibrium in the balance of payments that is consistent with the cost and price levels of trading partners.

While exchange rate shocks implies the ability of a country's currency relative to another country's currency to fluctuate over time. Exchange rate shocks are a term used to describe a phenomenon that occurs when the value of one currency spikes relative to another in an

extremely short period of time. Exchange rate shocks could depend on two basic policies, that is the fixed exchange rate policy and the flexible exchange rate policy. By fixed exchange rate policy (regime), we mean a situation, when the exchange rate is set and government is committed to buying and selling its currency at a fixed rate, while flexible exchange rate policy defines a situation when the exchange rate is set by market forces (demand and supply for a country's currency). Beyond directly influencing different economic channels, exchange rate shocks have policy implications which are not as easily understandable.

2.2 Theoretical Framework

The purpose of this study is to review some theories of monetary policy and exchange rate that could address their linkage in order to provide a framework for an empirical assessment on the effect of monetary policy shock on exchange rate volatility in Nigeria.

2.2.1 Theories of Monetary Policy

This study is anchored on IS-LM Model theory of Hick-Hansen 1970s and Funnel hypothesis of James Tobin 1981 as it linked to the long existing debate of the monetarists view on quantity theory of money. However, the linkage of these theories to the study is briefly explained below: The *IS – LM* model, is a framework of macroeconomic analysis propounded by John Hicks (1937) later expanded by Alvin Hansen in mid 1970s, simply call (Hick – Hansen model). This model analyzed the role monetary and fiscal policies in stabilizing the economy. It makes clear differences in the transmission mechanism between fiscal and monetary policy which could be used to analyze the effectiveness of monetary policy in relation to the Monetarists view (Lipsey & Chrystal 1999). The *LM* curve stands for monetary policy which describes the equilibrium points in the market for money. If the *LM* curve is horizontal, monetary policy is completely ineffective because the demand for money is perfectly interest elastic. This is the case of “liquidity trap”, where the increase in the money supply has no effect on the interest rate (*OR*) and the income level (*OY*). Conversely, if the *LM* curve is vertical, monetary policy is highly effective because the demand for money is perfectly interest inelastic. Autonomous changes in money demand and changes in the money supply are the only factors that can cause a change in the *LM* curve (Lipsey & Chrystal 1999).

On the other hand, the Funnel Theory (i.e. Fiscal – monetary policy mix) propounded by James Tobin (1981s) stated precisely the distinctions between the total stimulus administered by the fiscal and monetary policies and the relative contributions of each of the two policies to economic output aggregates. According to Tobin, Fiscal and monetary policy together determine aggregate dollar spending for GNP and they do not determine how dollar spending is divided between prices and quantities. In the theory, he used a schematic diagram to further illustrate his point that the mix of price/quantity outcomes is independent of the sources of aggregate dollar. Adding that, monetary policy affects the supply of money and fiscal policy affects circuit velocity. It is the product MV (money supply times circuit velocity), which is equal to dollar GNP, which represents demand for goods, services and labour and induces output and price response from business and workers.

2.2.2 Theory of Exchange rate

In general, two theories of exchange rate would be discussed to form the main theoretical frameworks upon which this study hinges; they include the purchasing power parity model, and the more modern asset market theory of exchange rate. The purchasing power parity is a simple theory of equilibrium exchange rate determination and is used mainly for cross-country composition of living standards and examining the productivity levels over time as well as determining the relative value of currencies (Vachris and Thomas, 1999 as cited by Omolara

et al; 2012). This theory is based on the proposition that exchange rates would adjust to equalize the relative purchasing power of currencies. Thus, it is expected that in perfectly competitive markets, identical products would trade at equivalent prices when valued in the same currency. The PPP theory is based on the notion that the exchange rate is dependent on the actual buying power over a basket of goods, and so changes in the nominal exchange rate should reflect changes in the prices of goods (Taylor and Taylor, 2002, as cited in Omalar et al; 2012). Thus, the PPP theory is rooted on the concept of the “law-of-one-price” which assumes that nominal exchange rates should change to compensate for price differentials across countries. In its simplest form, the law-of one-price can be expressed as:

2.3 Empirical Literature

The interrelationship between monetary policy shock and exchange rates has long been a focus of research in monetary and international economics. Numerous past studies that studied the relationship between monetary policy shocks and exchange rate volatility especially in developed countries and less developed countries comes up with different findings.

Dalla and Varelas (2013) investigated the influence of monetary policy on the optimal behavior of exchange rate using VECM. They discussed how the overdraft rate and the minimum reserve requirements affect the equilibrium values of lending rate and deposit rate as well as the corresponding quantities especially, when there is only one commercial bank in the economy and the Central Bank. Moreover, we examine the impact of these changes on the magnitude of the spread between the equilibrium rates and demonstrated that monetary policy via the overdraft rate does not affect the real exchange rate, while the effect of a change in the fraction of the minimum reserve requirements differs depending on the case.

An and Sun (2008) analyses the interaction among monetary policy, foreign exchange intervention and exchange rate in a unifying model for Japan. The study used ordinary least square model. The study addresses major research issues such as - Is the monetary policy the major source of the exchange rate fluctuation? In response to monetary policy shocks, do exchange rates “overshoot” their long-run values as implied by the uncovered interest rate parity (UIP)? An and Sun (2008) anchor their study on the “signaling” and the “leaning-against-the-wind” theoretical bases to explore the relationship among monetary policy, foreign exchange intervention and movement of exchange rate in Japan. The findings from the study lend support to the “leaning-against-the –wind” hypothesis and “signaling” hypothesis, but the evidence for the “signaling” hypothesis is minor. Second, intervention is ineffective or even counter-effective. Third, conventional monetary policy has a great influence on both exchange rate and foreign exchange intervention. The study concludes by pointing to the fact that in response to contractionary monetary policy shocks, the exchange rate appreciates for a short while with the maximum effect coming within several months, and then depreciates over time to the original level in Japan.

Ndung’u (2000), assesses whether the exchange rate in Kenya is affected by monetary policy and whether these effects are permanent or transitory. Using the error correction model, the study premise that the choice of the exchange rate regime is determined by various factors – such as the objectives pursued by the policy makers, the sources of shocks hitting the economy and the structural characteristics of the economy in question. The results of the study show that the nominal exchange rate in Kenya between 1970 and 1994 is determined by real income growth, the rate of inflation, money supply growth, the cycles in the real exchange rate volatility, the cointegrating vectors and the shocks. In addition, the results from the causality tests between the official exchange rate and the parallel rate show that even though the parallel market was illegal, the Central bank in determining the crawl (during the crawling rate regime in Kenya) took into account the value of the currency in the parallel market.

Cagliarini and Mckibbin, (2009), use the multi-sector and multi-country G-Cubed model to explore the potential role of three major shocks – to productivity, risk premia and US monetary policy – to explain the large movements in relative prices between 2002 and 2008. An interesting conclusion of the simulations exercise carried out by the study is that monetary policy tends to affect relative prices for up to four years because the effect of a temporary change in real interest rates varies across sectors. The effect depends on each sector's relative capital intensity as well as on the change in the demand for the output of each sector as consumption and investment adjust. Eventually the effect of monetary policy on relative prices dissipates.

In another work, Ahmed and Rafar (2009) utilized cointegration test, Ordinary Least Square (OLS) and Granger causality test to investigate the determinants of exchange stability in Nigeria from 1990 to 2007. The results from the estimated model indicated that a long-run relationship existed among the selected variables. The influence of money supply and cash reserve ratio was significant on exchange rate in the country. Also, the study asserted that there was an existence of a unidirectional causality between exchange rate and other variables of interest.

Similarly, Masha (2011) applied Johansen co-integration technique to estimate the link between monetary policy actions and exchange rate determination in Ghana with the annual data of 1982 to 2009. It was concluded from the study that prompt monetary action resulted into a short-term and long-term stability of exchange rate in the country. Therefore, the paper recommended that the government of the country should employed policy tools like interest rates, liquidity, money supply and cash reserve ratios to stabilize exchange rate. While examining how monetary policy impacts exchange rate and growth in Zambia within the period of 1992 and 2006,

Zulu and Paul (2008) used multiple regression models to establish the existence of a direct impact of money supply and liquidity ratio on exchange rate. Meanwhile, reverse was the case of minimum rediscount rate, exports and periodic policy changes on exchange rate. In the same vein, Hameed et al (2012) analyzed the impact of monetary policy on macro-economic variables such as money supply, GDP, exchange rates, interest rates, and inflation with the application of Ordinary least square OLS. The authors submitted that a tight monetary policy (in term of increase interest rate) contributed a significant adverse effect to output. But increase in money supply caused a noticeable direct impact on inflation which consequently contributed to a negative influence on output. Exchange rate and output had an inverse relationship with each other.

However, Umar (2013) employed Granger causality test and Error Correction Model (ECM) to examine how monetary policy determines exchange rate in Nigeria ranging from 1980 to 2011. The findings that emerged from the paper posited that money supply had a significant direct impact on exchange rate whereas monetary policy rate and liquidity ratio had a reverse effect on exchange rate. Consequently,

Chukuigwe and Abili (2008) adopted Ordinary Least Squares technique to investigate the impact of monetary and fiscal policies on non-oil exports in Nigeria between 1974 and 2003. It was discovered from the study that both interest rate and exchange rate exerted a negative impact on non-oil exports, while estimating the connection between exchange rate regimes and international business cycles.

Oliver and Thepthida (2005) embraced a general equilibrium model to establish two sources of real exchange rate fluctuations as relative interest rate changes and movement in the relative price of imports across countries. It was further concluded that monetary growth had significant effects on exchange rate.

In addition, Zafar and Sabo (2013) utilized multiple regression models to analysis the nexus between monetary policy and exchange rate between 1980 and 2010. The researchers

discovered from the estimated model that the effects of money supply, monetary policy rate, Treasury bill rate and cash reserve ratio were negative and significant on exchange rate. The paper submitted that the implementation of monetary policy decisions on timely and effective manner would be the best solution to the issues of exchange rate management.

Meanwhile, Ajisafe and Folorunsho (2002) estimated the relative effectiveness of monetary and fiscal policy on macroeconomic variables in Nigeria between 1970 and 1998 with the aid of cointegration and error correction model. The study corroborated that monetary policy exercised greater impact on the Nigerian economic variables than fiscal policy. It was therefore concluded that the past advocacy by the government to embark on fiscal measures has resulted into greater distortion in the economy.

Furthermore, Amassoma et al (2011) utilized Ordinary Least Squared approach to evaluate how monetary policy affects macroeconomic variables in Nigeria ranging from 1986 to 2009. The results originated from the work concluded that monetary policy exerted a significant influence on both money supply and exchange rate while reverse was the case on price stability. Aderemi, Akinwande, Olayemi et al (2019), carried out a study on impact of monetary policy on exchange rate in Nigeria: Bound Test and ARDL Approach. Data was collected from the Central Bank of Nigeria Statistical Bulletin from 1990– 2016 and various diagnostic tests such as Unit Roots and Bound Tests were carried out. Consequently, ARDL model was utilized to address the objective of this study. It was discovered in this study that credit reserve requirement and Treasury bill rate have a negative relationship with exchange rate. However, monetary policy rate and broad money supply have a positive relationship with exchange rate in the country. The study recommended that Central bank should increase that rate at which it sells Treasury bill to the commercial banks. The multiplier effect of this policy will reduce the level of high powered money and consequently stabilize the exchange rate.

Babatunde and Olufemi (2005) conducted a work on monetary policy shocks and exchange rate volatility in Nigeria. The study applies the classical ordinary least square to examine the short-run monetary policy determinants of exchange rate volatility in Nigeria. Also, the error correction mechanism model was estimated after establishing the long-run interaction among set of incorporated variables using the Engle-Granger approach. The results from the study show that both real and nominal exchange rates in Nigeria have been unstable during the period under review. In the short run, the variation in the monetary policy variable explains the movement/behaviour of exchange rate through a self-correcting mechanism process with little or no intervention from the monetary authority (CBN). In addition, the results from the causality tests between the exchange rate volatility and monetary policy variables showed that there is a causal link between the past values of monetary policy variables and the exchange rate.

3.0 Analytical Methodology

In addition to the descriptive approach in the preceding section, the study now adopts an econometric approach in its empirical analysis of the relationship between fiscal policy, stability and economic growth of the Nigeria economy. The data used in this study are basically secondary data collected mainly from central Bank of Nigeria's statistically bulletin. The data used in this study are yearly time series data for the period of study, 1981-2018.

3.1 Specification of Empirical Model

The objective of this section is to formulate models that will assist in achieving our stated objectives. Econometric technique is used to establish a model of the relationship between exchange rate volatility and monetary policy shocks in Nigeria. The model which captures the

impact of monetary policy tools in achieving stable exchange rate in Nigeria could be represented as follows:

$$EXR = f(MS, REQ, MPR, INFR) \dots\dots\dots (3.1)$$

Econometrically, equation (1) is transformed into an econometric linear form thus:

$$EXR_t = \beta_0 + \beta_1 MS_t + \beta_2 REQ_t + \beta_3 MPR_t + \beta_4 INFR_t + \mu_t \dots\dots\dots (3.2)$$

Transforming equation 2 to the natural logarithm, we have:

$$\log(EXR_t) = \beta_0 + \beta_1 \log(MS_t) + \beta_2 \log(REQ_t) + \beta_3 \log(MPR_t) + \beta_4 \log(INFR_t) + \mu_t$$

A priori expectations of signs of parameters as contained in section 4.2 are:

$$\beta_1, \quad \beta_3 \text{ and } \beta_4 > 0, \quad \text{while } \beta_2 < 0$$

Where

EXR = Exchange rate

MS = Broad Money supply

REQ = Reserve Requirement

MPR = Monetary policy rate

INFR = Inflation rate

This paper adopts an econometric technique that is rooted in co-integration while the method of estimation is the error correction model (ECM). The choice of error correction is informed by the fact that it is BLUE. The steps includes the testing of the series individually for stationarity using the Engle and Granger (1987) two step approach to determine the order of integration of the variables using the Augmented Dickey-Fuller (ADF) set of unit root test (Audu, 2010). After that we proceeded to search for the existence of long-run equilibrium causal relationship between monetary policy instruments and the exchange rate volatility as stated in the model.

The unit root and the Error Correction Model (ECM) are generally presented as follows.

Unit Root Model

$$\Delta Y_t = \alpha Y_{t-1} + \sum_{i=1}^m B \Delta Y_{t-1} + \delta + Y_t + \varepsilon_t \text{ (For levels)}$$

$$\Delta \Delta Y_t = \alpha \Delta Y_{t-1} + \sum_{i=1}^m B \Delta \Delta Y_{t-1} + \delta + Y_t + \varepsilon_t \text{ (For first difference)}$$

Where;

ΔY is the first difference of the series, m is the number of lags and t is the time.

Error Correction Model

The error correction model for two variables X and Y is stated generally as:

$$\Delta Y_t = \alpha_0 + \alpha_1 \Delta X_t + \alpha_2 U_{t-1} + \varepsilon_t$$

Where; α_2 is the degree of adjustment.

4.0 Presentation and Analysis of Empirical Results

4.1 Unit root tests

Table 1 below shows regression for the purpose of clarifying the result for the augmented-Dickey-Fuller test (ADF) class of unit root test. It was found that all the variables of the study exhibited unit root process at various critical levels but mostly at 5% level of significance. In other words, all the variables except reserve requirement and were found to be non-stationary at their levels but stationary at their first differences. Reserve requirement ratio was found to be stationary at second difference.

Table 1. Summary of ADF Unit Root Test

Variables	ADF Test Statistics			d (I)	Remark
	@ level	@ 1 st Diff	@ 2 nd Diff		
EXR	-1.945780	-4.548285	-	I (1)	Stationary
MS	2.228258	-4.757826	-	I (1)	Stationary
REQ	5.931496	3.897712	-6.405593	I (2)	Stationary
MPR	-3.196615	-8.388052	-	I (1)	Stationary
INFR	-3.411295	-6.047697	-	I (1)	Stationary
Test critical values	1% level	-4.226815			
	5% level	-3.536601			
	10% level	-3.200320			

Source: Authors own computation using E view 9

4.2 Cointegration Test

Having established stationary of the variables, we determine the existence of a long-run equilibrium relationship among the variables in the model. To realize this, the study employed the Johansen cointegration technique. The cointegration results of the variables are presented.

**Table 2: Johansen Cointegration Rank Test Result
Unrestricted Cointegration Rank Test (Trace)**

Hypothesized	Trace		0.05	
No. of CE(s)	Eigenvalue	Statistic	Critical Value	Prob.**
None *	0.821697	113.3656	69.81889	0.0000
At most 1 *	0.507597	51.29190	47.85613	0.0230
At most 2	0.242460	25.78739	29.79707	0.1352
At most 3 *	0.229731	15.79096	15.49471	0.0451
At most 4 *	0.162742	6.394412	3.841466	0.0114

Trace test indicates 4cointegratingeqn(s) at the 0.05 level

Unrestricted Cointegration Rank Test (Trace)

Hypothesized	Trace		0.05	
No. of CE(s)	Eigenvalue	Statistic	Critical Value	Prob.**
None *	0.821697	62.07370	33.87687	0.0000
At most 1	0.507597	25.50450	27.58434	0.0901
At most 2	0.242460	9.996439	21.13162	0.7450
At most 3	0.229731	9.396543	14.26460	0.2546
At most 4 *	0.162742	6.394412	3.841466	0.0114

Max-eigenvalue test indicates 2cointegratingeqn(s) at the 0.05 level

The result of the Johansen co-integration test presented above indicates at least four co-integration equations. The result therefore confirms the existence of cointegration among the variables. Consequently we can conclude that there exist a long run relationship between monetary policy and exchange rate volatility in Nigeria.

4.3 ORDINARY LEAST SQUARE REGRESSION RESULT

Table 3. Short run Static Regression Result

Dependent variable: Log(EXR)

Variable	Coefficient	Std. Error	t-Statistic	Prob.
C	-5.998537	0.470380	-12.75252	0.0000
LOG(MS)	0.809904	0.027980	28.94554	0.0000
REQ	-0.000255	5.62E-05	-4.538917	0.0001
LOG(MPR)	1.131715	0.253359	4.466850	0.0001
LOG(INFR)	0.565270	0.259155	2.181209	0.0364

R-Square = 0.976, F-Statistic = 336.74, Prob(F-Statistic) = 0.0000, Durbin-Watson = 1.3956

Source: Authors own computation using E view 9

From the above results, the model shows broad money supply, interest rate and inflation rate is positively related to exchange rate and is statistically significant at 5% level. While reserve requirement ratio is negatively related to exchange rate and is also statistically significant at 5% level.

The f-statistic is used to test for a simultaneous significance of all the estimated parameters and the result showed that they are all simultaneously significant. This is so because the f-calculated (336.74) is greater than the f-tabulated value. The Durbin-Watson test showed that there is a presence of serial correlation in the residual as its value (1.40) which is less than 2. The Coefficient of Determination (R^2) which measures how well the sample regression line fits the data is considered high, about (0.9761) or 98 percent. This implies that about 98 percent of the regression model was explained by the explanatory variables (monetary policy instruments) while 2 percent was unexplained.

4.4 Error Correction Mechanism

The error correction model measures the speed of adjustment to equilibrium. The error correction model (ECM) is significant if it has a negative sign. This implies that the present value of the dependent variable adjust rapidly to changes in the independent variable. A higher percentage of ECM indicates a feedback of that value or an adjustment of that value from the previous period disequilibrium of the present level of depend variable and the present and past level of the independent variables.

Table 4: Error Correction Mechanism

Dependent Variable: Dlog(EXR)

Variable	Coefficient	Std. Error	t-Statistic	Prob.
C	0.088434	0.151467	0.583851	0.5655
DLOG(EXR(-1))	0.484807	0.185741	2.610128	0.0163
DLOG(EXR(-2))	0.115591	0.171818	0.672755	0.5084
DLOG(EXR(-3))	0.173209	0.154498	1.121107	0.2749
DLOG(MS)	0.775450	0.050768	3.720287	0.0001
DLOG(MS(-2))	-0.817205	0.383602	-2.130345	0.0451
D(REQ)	-0.000355	0.000148	-2.400427	0.0257
D(REQ(-1))	7.35E-05	0.000151	0.485456	0.6324
DLOG(MPR)	0.557378	0.225465	2.472123	0.0221
DLOG(MPR(-1))	-0.595728	0.262161	-2.272378	0.0337
DLOG(INFR)	0.382194	0.195883	1.951137	0.0645
DLOG(INFR(-2))	-0.113649	0.201691	-0.563482	0.5791
ECM(-1)	-0.959506	0.234607	-4.089836	0.0005

R-Square = 0.6305, F-Statistic = 12.986, Prob(F-Stat) = 0.0137, Durbin-Watson = 2.022

Source: Authors own computation using E view 9

Table 4 indicates that the coefficients of money supply, interest rate in terms of monetary policy rate and inflation rate is positively related to both real and nominal exchange rate and is statistically significant at 5% level. While reserve requirement ratio is negatively related to exchange rate and is also statistically significant at 5% level. The result is in conformity with theoretical and our apriori expectation. Table 4 indicates that the error correction term (ECM) has the correct a priori sign. The existence of a well specified error correction model indicates how agents adjust to their anticipated changes, in this case about 96 percent on the average. The nature of the distribution of the error term indicates that it is stationary. A priori expectations about the signs of the parameters were met in all the variables. There is overall significance of our model since the value of F statistic is 12.986. The null hypothesis is rejected. This means that monetary policy tools can be used to correct exchange rate volatility in Nigeria. There exists no serial correlation as the value of our Durbin-Watson statistics is 2.02. The value of our R^2 is 0.63 which indicates that 63 percent of the total variation of exchange rate volatility is explained by monetary policy instruments and inflation rate in Nigeria.

4.5 Pairwise Granger Causality Test

In causality relationships, the critical tests to be done is the F-test which is important in the process of making the decision rule concerning the direction of causation. The results of the Granger causality tests are presented in table 5

Null Hypothesis	Obs	F-Statistic	Prob.	Decision
MS does not Granger Cause EXR	36	4.58843	0.0180	Reject
EXR does not Granger Cause MS	36	3.32250	0.0493	Reject
REQ does not Granger Cause EXR	36	4.64120	0.0173	Reject
EXR does not Granger Cause REQ	36	1.82535	0.1781	Accept
MPR does not Granger Cause EXR	36	0.00936	0.9907	Accept
EXR does not Granger Cause MPR	36	0.57976	0.5660	Accept
INFR does not Granger Cause EXR	36	1.20166	0.3143	Accept
EXR does not Granger Cause INFR	36	0.92420	0.4075	Accept
REQ does not Granger Cause MS	36	0.79633	0.4600	Accept
MS does not Granger Cause REQ	36	11.6180	0.0002	Reject
MPR does not Granger Cause MS	36	0.86614	0.4305	Accept
MS does not Granger Cause MPR	36	0.89527	0.4188	Accept
INFR does not Granger Cause MS	36	1.29516	0.2883	Accept
MS does not Granger Cause INFR	36	0.39774	0.6752	Accept
MPR does not Granger Cause REQ	36	0.50989	0.6055	Accept
REQ does not Granger Cause MPR	36	0.12712	0.8811	Accept
INFR does not Granger Cause REQ	36	0.02416	0.9761	Accept
REQ does not Granger Cause INFR	36	1.10119	0.3451	Accept
INFR does not Granger Cause MPR	36	0.09823	0.9067	Accept
MPR does not Granger Cause INFR	36	1.31851	0.2821	Accept

From the table above, there is bi-directional causality between exchange rate and money supply in Nigeria using 5% level of significance. This is because the null hypothesis of money supply does not Granger causes exchange rate was rejected just like the null hypothesis of exchange rate does not Granger Cause money supply was also rejected. Likewise reserve requirement granger cause exchange rate but exchange rate does not granger cause reserve requirement. Furthermore, money supply granger cause reserve requirement but reserve requirement does not granger because money supply all things being equal.

5.0 Conclusion and Recommendations

This study has examined the relationship between exchange rate variation and monetary policy shock in Nigeria between the periods of 1981 and 2018 using vector error correction model (VECM). The findings originated from this work could be summarized as follows: credit reserve requirement has a negative relationship with exchange rate in the long run. Conversely, broad money supply, interest rate and inflation rate have a positive relationship with exchange rate in the country. The implication of this result is that when exchange rate stability is the target of policy makers in Nigeria, manipulating the monetary policy variables will induce exchange rate accordingly in both the short and long run.

- 1) Due to the high volatility in exchange rate in Nigeria currently, it is a matter of urgency that the monetary authorities should increase the credit reserve requirement of the commercial banks. Also, the Central bank should increase the interest rate at which it sells Treasury bill to the commercial banks. The multiplier effect of this policy will reduce the level of high powered money and consequently stabilize the exchange rate in the short run.
- 2) The monetary authorities should embark on contractionary monetary policy. This will cause declining in the level of broad money supply and monetary policy rate and eventually lower exchange rate depreciation in the country.

References

- Aderemi T. A., Akinwande S. A., Olayemi H. O., et al (2019). Impact of monetary policy on exchange rate in Nigeria: Bound Test and ARDL Approach. *Journal of Economics. ACTA UNIVERSITATIS DANUBIUS* Vol 15, no 4, 2019
- Ahmed, M.L. & Rafar S. (2009). Determinants of Exchange rate: The role of Monetary Policy in Nigeria. *Journal of Economic Theory*, Vol. 5, no. 2.
- Ajisafe, R.A. & Folorunso, B.A. (2002). The Relative Effectiveness of Fiscal and Monetary Policy in Macroeconomic Management in Nigeria. *The African Economic and Business Review*, Vol. 3, pp. 23-40.
- Amassoma, O.; Ditimi, N.; Nwosa, P. & Olaiya, S. (2011). An Appraisal of Monetary Policy and Its Effect on Macro Economic Stabilization in Nigeria. *Journal Trends in Economics and Management Science*, Vol. 2, pp. 233-237.
- An, L. and W. Sun, (2008). Monetary Policy, Foreign Exchange Intervention, and The Exchange Rate: The Case of Japan. *International Research Journal of Finance and Economics*. 15(2008): 271-283.
- Babatunde W. A. and Olufemi M. S. (2005). Monetary policy shocks and exchange rate volatility in Nigeria. *Asian Economic and Financial Review*, 2014, 4(4):544-562
- Cagliarini, A. and W. Mckibbin, 2009. Global relative price shocks: The role of macroeconomic policies. *RBA Research*, 25(4): 581-607.
- Central Bank of Nigeria (2009). *CBN Briefs, 2008 – 2009 Edition, Research Department*, CBN: Abuja.
- Chukuigwe, E.C. & Abili, I.D. (2008). An Econometric Analysis of the Impact of Monetary and Fiscal Policies on Non-Oil Exports in Nigeria. *African Economic and Business Review*, Vol. 6, pp. 59-64.
- Dalla, E. and E. Varelas, (2013). Monetary Policy And The Behavior Of A Monopolistic Bank: A Theoretical Approach *Asian Economic And Financial Review*, 3(11): 1439-1450.
- Dornbusch, Rudiger (2004). "Expectations and exchange rate dynamics." *Journal of political Economy* 84, no. 6: 1161-1176.
- Dornbusch, R., (1986). Multiple exchange rates for commercial transactions, in S. Edwards and L. Ahamed (eds), *Economic Adjustment and Exchange Rate Changes in Developing Countries*, Chicago: The University of Chicago Press.
- Dwivedi, D.N. (2005). *Managerial Economics Sixth Edition* VIKAS Publishing house PVT

LTD New Delhi India.

- Garber, M. Peter and L.E.O. Svensson, (1995). The operation and collapse of fixed exchange rate regimes. In Gene M. Grossman and Kenneth Rogoff(eds.), *The Handbook of International Economics*, Amsterdam, Elsevier Press, 3.
- Hameed, G.; Khalid, M. &Sabit, R. (2012) Linkage between Monetary Instruments and Economic Growth. *Universal Journal of Management and Social Sciences*, Vol. 2, pp. 69-76.
- Jhingan, M. L. (2008): *Monetary Economics* 6th Ed. Vrinda Publications Ltd., Delhi.
- Lypsey, R. G. and Chrystal K.A (1999). *Principles of Economics*, London: Vancouver BC
- Masha, S.L. (2011). Economic Implications of Monetary Policy Actions on Exchange Rate. *International Journal of Economic development Research and Investment*, Vol. 2, no. 2.
- Ndung'u, N.S., (2000). Monetary and Exchange Rate Policy in Kenya,.AERC Research Paper No. 94.
- Nnanna, O.J., (2002). Monetary Policy and Exchange Rate Stability in Nigeria, Nigerian Economic Society – Proceedings of a One-day Seminar on Monetary Policy and Exchange rate Stability, Federal Palace Hotel, Lagos.
- Obstfeld, M. and R. Kenneth, (1996). *Foundations of International Macroeconomics*, MIT Press.
- Ogunjimi, S.O (1997). *Public Finance: For Polytechnics ICAN Students*. Bida: Lekem Productions
- Oliver, D. &Thepthida S. (2005). Exchange rate regimes and International Business cycles. *Review of Economic Dynamics*, Vol. 4, no. 2.
- Omolara O. Duke, Oladunni A. and Ribadu A. Ahmadu (2012) “still on the Equilibrium Real Exchange Rate of the Naira: A Real Examination” Central Bank of Nigeria: A Journal of Economic and Financial Review (Vol. 50, no 3).
- Philippe, A., B. Philippe, R. Romania and R. Kenneth (2006). Exchange rate volatility and productivity growth: The Role of Financial Development. *NBER Working Paper (10.1.1.153.3468)*.
- Umar, S.L. (2013) Monetary Policy and Exchange rate Determination in Nigeria. *Journal of Business Studies*, Vol. 3, no. 4.
- Zafar, M.S. & Sabo, S. (2013). The Effects of Monetary Policy on Exchange rate Determination. *Journal of Social Sciences*, Vol. 24, no. 2, pp. 24-36.
- Zulu, S.B. & Paul, L. (2008). Impact of Monetary Policy on exchange rate and Growth. *International Journal of Social Sciences*, Vol. 9, no. 4, pp. 84-100.