Monetary Policy and Macroeconomic Volatility in Nigeria

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Abstract: Macrconomic volatility encompasses a range of indicators including high inflation, elevated unemployment rates, diminished GDP growth, and fluctuations in currency stability. It is intimately tied to the cyclical nature of business, marked by periods of growth and contraction. Central banks wield monetary policy as a tool to temper these fluctuations, utilizing adjustments in interest rates and money supply to stimulate or restrain economic activity. This study delves into the intricate relationship between monetary policy and macroeconomic volatility in Nigeria. It investigates the impact of monetary instruments, including money supply, interest rates, and exchange rates, on key economic indicators such as inflation and economic growth. The research employs a quasi-experimental approach, combining theoretical insights with empirical observations spanning from 1985 to 2021. Through rigorous econometric analysis, including multiple linear regression, the study discerns the causal links and quantifies the significance of these monetary policy variables on Nigeria's economic stability. The findings offer valuable insights for policymakers seeking to mitigate economic volatility and promote sustainable growth.

Keywords: Monetary Policy, Macroeconomic Volatility, Nigeria, Inflation, Economic Growth, Money Supply, Interest Rates, Exchange Rates, Quasi-Experimental Approach, Econometric Analysis.

1. INTRODUCTION

Economic volatility is the state of an economy characterized by high inflation, high unemployment, decline growth in GDP, and currency instability. It is typically associated with business cycles, characterized by periods of expansion (boom) and contraction (recession). Central banks can use monetary policy to smooth out these cycles by adjusting interest rates and money supply to stimulate or restrain economic activity. Lowering interest rates during a recession encourages borrowing and investment, while raising rates during a boom helps control excessive growth

and inflation. Monetary policy plays a crucial role in managing and stabilizing economies. It plays a pivotal role in maintaining economic stability by managing interest rates, controlling inflation, promoting investment, and ensuring the soundness of the financial system. When implemented appropriately, it can help achieve long-term economic growth, reduce income inequality, and improve the overall well-being of individuals and the entire economy. However, it can also contribute to economic instability under certain circumstances.

Monetary policy refers to the actions taken by the central bank or monetary authority of a country to regulate the supply of money, control interest rates, and influence the overall economic activity and stability. One of the primary objectives of monetary policy is to control inflation. If a central bank believes that inflation is rising beyond acceptable levels, it may implement contractionary monetary policy measures, such as raising interest rates or reducing the money supply. However, if these measures are implemented too aggressively or for an extended period, they can lead to economic instability. High interest rates can discourage borrowing and investment, leading to reduced consumer spending and a slowdown in economic growth. The link between currency in circulation and inflation rate is the key gauge for assessing an economy's prosperity, performance, and growth potential. Controlling the amount of money in circulation and ensuring price stability has been a significant goal for developing countries like Nigeria. Monetarist economists argue that there is a causal relationship between inflation and money supply, and an uncontrolled increase in the money volume can harm the economy (Chaudhry, Ismail, Farooq and Murtaza 2015 and Iwedi, 2016). The main aim of Nigerian policymakers is to maintain price stability and keep inflation rates at single digits. They pursue this goal by manipulating monetary policy instruments to ensure a stable and robust financial system, promoting economic growth (Iwedi, 2019). According to Fabian and Charles (2014), the Central Bank of Nigeria (CBN) employs monetary policy as a key tool to regulate financial activities through the monetary policy rate (MPR), which was introduced in late 2006 to influence economic activities in the money market. The effectiveness of monetary policy hinges on the prevailing economic environment, the adopted institutional framework, and its implementation by the CBN, which has been responsible for regulating the money supply since its establishment in 1959, consistently striving to enhance the welfare of Nigerians. The current monetary policy framework primarily focuses on maintaining price stability, while growth and employment promotion serve as secondary objectives. Inflation targeting and exchange rate policy dominate the CBN's monetary policy agenda, as they are deemed crucial instruments for achieving macroeconomic stability.

However, there has been a surge in inflation in Nigeria since the late 1970s, resulting from factors like civil war, salary increases, and excessive government spending. Inflation became a serious issue in the 1980s, marked by military interventions in governance. In the 1990s, the inflation rate rose from 63.6% to 72.8%. Economic reforms in 2003 brought stability, with inflation rates of 12% and 14% in 2000 and 2001 respectively. However, from 2002 to 2005, headline inflation remained in double digits at 15% and 17.9% respectively. It then decreased significantly to 8.24% and 5.38% in 2006 and 2007, before rising again to 11.8% and 12.3% in 2014 and peaking at 15.17% in 2016. Regarding price changes, inflationary pressure has been consistently increasing. Headline inflation rose from 11.98% in December 2019 to 22.79% in June 2023. This growth can be attributed to moderate increases in both food and core components. Several persistent challenges, such as security issues in major food-producing regions, high transportation costs due to rising energy prices, and insufficient public infrastructure, are contributing to the rise in food and core inflation. In the short to medium term, key factors that will likely maintain upward pressure on domestic prices include the recent deregulation of petrol prices and the shift towards a unified and market-determined exchange rate. Given these unfolding dynamics in the policy environment and their impact on domestic prices, it is crucial for the Bank and the fiscal authority to enhance collaboration. This persistent inflation volatility in Nigeria since the early 1980s poses a major challenge to policymakers, necessitating research on its causes and measures to reduce it. Inflation adversely affects the standard of living in an economy. This necessitates the study due to the growing rise in the cost of goods and services in the country.

2.   THEORETICAL AND EMPIRICAL REVIEW

2.1. Theoretical Framework

Monetarist Theory

Monetarist theory is an economic theory that places a strong emphasis on the role of the money supply in determining the level of economic activity. It was popularized by economists such as Milton Friedman and Anna Schwartz, and gained prominence in the 1960s and 1970s. Monetarism emphasizes the role of money supply in determining economic fluctuations. It argues that changes in the money supply can lead to changes in aggregate demand and, consequently, fluctuations in economic activity. Key principles and components of Monetarist Theory include:

The Quantity Theory of Money

The Quantity Theory of Money is a fundamental concept in economics that provides insights into the relationship between the money supply and the price level in an economy. It suggests that changes in the quantity of money circulating in an economy have a direct and proportional effect on the general price level. This theory has been influential in shaping monetary policy frameworks around the world. The Quantity Theory of Money is often represented by the equation of exchange, which was first formulated by the 16th-century philosopher and economist, Jean Bodin, and later refined by the classical economists like David Hume, John Stuart Mill, and Irving Fisher. The equation of exchange is expressed as:

$$MV=PY$$

Where:
M represents the money supply in an economy.
V stands for the velocity of money, which is the average number of times a unit of currency is spent in a given period.
P represents the average price level of goods and services in the economy.
Y denotes the real output or the total quantity of goods and services produced.

This equation serves as a starting point for understanding how changes in the money supply affect the overall economic activity and price levels. In summary, the Quantity Theory of Money provides a framework for understanding the relationship between the money supply and the general price level in an economy. While it serves as a valuable analytical tool, it's important to recognize its limitations and consider it in conjunction with other economic theories and real-world complexities when making policy decisions. In Nigeria, controlling the money supply is crucial for managing inflation, which has been a persistent challenge. Monetarists advocate for a stable and predictable growth rate of the money supply to achieve long-term economic stability.

Keynesian Theory

The Keynesian approach focuses on aggregate demand as the primary driver of economic fluctuations. It argues that changes in consumer spending, business investment, government spending, and net exports can lead to economic ups and downs. Keynesian Theory advocates for active government intervention in the economy to stabilize output and employment levels, especially during economic downturns. This means that the theory suggests that government intervention,

including monetary policy, is necessary to stabilize an economy. It places a strong emphasis on the management of aggregate demand as a means to achieve economic stability and growth. While it has been subject to criticism and modifications over the years, Keynesian principles continue to be influential in modern macroeconomic policy-making. In Nigeria, this theory supports the use of monetary policy tools to manage demand, stimulate economic growth, and stabilize employment. Keynesian theory emphasizes that changes in consumption and investment spending can have a multiplier effect on the economy, amplifying the initial impact. According to Keynesians, government policies, such as fiscal and monetary measures, can be used to stabilize the economy during periods of volatility.

2.2. Empirical Review

Ayomitunde, Akinwuyi, Omotayo & Abayomi (2019) scrutinized the connection between the monetary authority's policy instruments and the exchange rate in Nigeria. The study applied the Autoregressive Distributed Lag (ARDL) model to achieve its specific objectives. The results demonstrated a negative relationship between the Treasury bill rate and cash reserve requirement with the exchange rate. Conversely, the policy rate and broad money supply showed a positive nexus with the exchange rate in Nigeria. Okotori (2019) conducted a study on "the dynamics of monetary policy and inflation in Nigeria." They analyzed monthly data from 2009 to 2017 and employed the Augmented Dickey-Fuller (ADF) unit root test, Johansen Cointegration test, and Error Correction Model (ECM). The findings indicated that all variables were stationary at first order, except for money supply and exchange rate, which were stationary at second order. The Johansen test suggested a long-run equilibrium between the variables and concluded that money supply, exchange rate, monetary policy rate, treasury bills rate, reserve requirement, and liquidity ratio significantly influenced inflation rate. The study recommended that the Central Bank of Nigeria (CBN) should maintain its current exchange rate policy and utilize monetary policy tools to control inflation in Nigeria.

Oumbe' (2018) examined the "impact of monetary policy on inflation" and the "relationship between money supply and inflation in Cameroon." They used time series annual data from 1980 to 2016. The study employed the Johansen Cointegration test to determine the relationship between money supply and inflation and used the Autoregressive Distributed Lag (ARDL) estimation technique to assess the effect of money supply on inflation in Cameroon. Additionally, Toda and Yamamoto's causality test was used to examine the causality between money

supply and inflation. The results demonstrated a long-run equilibrium relationship between money supply and inflation.

Abdulkareem and Abdulhakeem (2016) offer a comprehensive analysis of the modeling of macroeconomic and oil price volatility within the context of Nigeria. The study predominantly employs the GARCH model and its variations (GARCH-M, EGARCH, and TGARCH) using data on a daily, monthly, and quarterly basis. The results demonstrate the high volatility of all considered macroeconomic factors, including real gross domestic product, interest rates, exchange rates, and oil prices. Moreover, the study highlights that asymmetric models (TGARCH and EGARCH) exhibit superior performance compared to symmetric models (GARCH (1,1) and GARCH-M). Furthermore, it emphasizes that oil prices play a pivotal role in driving macroeconomic volatility in Nigeria. Consequently, the study concludes that asymmetric models should receive greater attention in addressing macroeconomic volatility in Nigeria, and underscores the significance of incorporating oil price volatility as a pertinent variable in the examination of macroeconomic fluctuations in the country.Gbadebo and Mohammed (2015) investigated the effectiveness of monetary policy in controlling inflation in Nigeria. They analyzed time series data collected from 1980 to 2012 using cointegration analysis and error correction models. The study identified interest rate, exchange rate, money supply, and oil prices as major factors influencing inflation in Nigeria. Money supply showed a significant positive impact on inflation in both the short and long run, leading to the conclusion that monetary impulses were a cause of inflation in Nigeria.

Emerneni and Eke (2014) studied the determinants of inflation in Nigeria using the OLS technique and cointegration analysis, with data collected between 2007 and 2014. Their econometric model regressed inflation as a function of money supply, treasury bill rate, monetary policy rate, and exchange rate. The study found that money supply and exchange rate positively influenced inflation, while treasury bill rate and monetary policy rate did not. Raymond (2014) examined the impact of money supply, interest rate, cash reserve ratio, liquidity ratio, and exchange rate on inflation in Nigeria, analyzing data from 1980 to 2010 using OLS techniques. The study revealed that liquidity ratio and interest rate were effective in combating inflation, while cash reserve ratio, money supply, and exchange rate had a less significant impact. Iya and Aminin (2014) investigated the determinants of inflation in Nigeria between 1980 and 2012 using ordinary least square (OLS) method. Their results showed that money supply and interest rate positively influenced inflation, while government expenditure and exchange rate had negative effects.

They suggested that achieving price stability in the economy might be possible by reducing money supply and interest rates while increasing government expenditure and the exchange rate. Adeoye and Saibu (2014) analyzed the influence of monetary policy shocks, induced by movements in policy instruments, on the volatility of the exchange rate in Nigeria. The study specifically focused on the relationship between exchange rate volatility and monetary policy shocks in Nigeria. The short-term dynamics unveiled that alterations in monetary policy instruments were linked to variations in the exchange rate through a self-correcting process, even without the involvement of the Central Bank of Nigeria (CBN). Furthermore, the findings from the causality test connecting exchange rate volatility and the monetary authority's policy tools indicated a significant historical relationship between past values of the exchange rate and monetary policy variables. It was noted that shifts in past values of policy tools led to changes in exchange rate volatility.

Musa et al. (2013) assessed the effectiveness of the interaction between monetary and fiscal policies on price and output growth in Nigeria. They used pulse response and variance decomposition analysis and found that money supply and government revenue had a more significant impact on price and economic growth in Nigeria, especially in the long run. Asuquo (2012) evaluated inflation control through monetary policy measures in Nigeria from 1973 to 2010. Using multiple regression models and ordinary least squares estimation techniques, Asuquo showed that money supply, interest rate, and exchange rate had a significant impact on inflation, while domestic credit was not statistically significant. Sanni et al. (2012) empirically investigated the use of fiscal and monetary policy in controlling economic activities in Nigeria from 1960 to 2011. They used the Error Correction Mechanism (ECM) approach and found that monetary policy instruments had more influence on Nigeria, but fiscal policy granger caused GDP more than monetary policy, indicating the need for a balanced approach. Gul et al. (2012) studied the impact of monetary instruments on macroeconomic variables in Pakistan, including inflation, interest rate, real GDP, exchange rate, and money supply, using OLS analysis. The results showed that money supply had a strong positive correlation with inflation but a negative correlation with output. Exchange rate also negatively affected output in Pakistan. In Dickson's (2012) study, an investigation was conducted to assess how volatility in the real exchange rate affects Nigeria's output growth. This was done by utilizing annual data spanning from 1970 to 2009. The findings revealed that in the short term, there was a positive relationship between economic growth and exchange rate volatility. However, in the long term, both variables exhibited a negative correlation.

Nenbee and Madume (2011) examined the impact of monetary policy on Nigeria's macroeconomic stability between 1970 and 2009, focusing on price stability. They used cointegration and Error Correction Modeling (ECM) techniques and found that only 47 percent of the variations in prices were explained by monetary policy variables, indicating a mixed impact on inflation. McCallum and Nelson (2010) considered the relationship between monetary aggregates and inflation, challenging the view that monetary policy's effectiveness depends on the long-run "neutrality of money." They argued that the effectiveness of monetary policy is influenced by various factors. Adebiyi (2009) investigated the relationship between inflation and monetary policy instruments in Nigeria and Ghana using a vector autoregressive model. The study found that inflation was an inertial phenomenon in both countries, with money innovations having a limited effect on prices in the short run. Adebiyi (2007) delved into the impact of the involvement of Nigeria's monetary authority in the currency exchange market. Rather than concentrating on the connection between policy moves by the monetary authority and shifts in exchange rates, the research examined whether the interventions of the local monetary authority in the foreign exchange market were sterilized or not. Folawewo and Osinubi (2006) explored how monetary policy objectives and fiscal deficit financing affected inflation variability and real exchange rates. Their rational expectation framework revealed that the monetary authority's efforts to influence fiscal deficit financing impacted inflation and real exchange rates, causing volatility. Danjuma et al. (2002) examined the impact of monetary policy on inflation in Nigeria using the least square techniques and granger causality. They identified liquidity ratio and interest rate as leading monetary policy instruments in combating inflation, while cash reserve ratio, broad money supply, and exchange rate had less influence. Busari et al. (2002) argued that monetary policy better stabilizes the economy under a flexible exchange rate system but can lead to depreciation, necessitating complementary policy measures for macroeconomic stabilization. Nnanna (2001) discussed the evolution of monetary policy in Nigeria and its effectiveness, highlighting the challenges posed by fiscal dominance, political interference, and the legal environment in which the central bank operates.

3. METHODOLOGY

This study employed quasi-experimental approach, combining theoretical considerations with empirical observations to analyze the impact of monetary policy on macroeconomic volatility in Nigeria. Financial time series data were

collected from the Central Bank of Nigeria statistical bulletin covering the period from 1985-2021. The information on money supply, monetary policy rate, interest rate, and exchange rate were analyzed using multiple linear regression, a quantitative technique employing ordinary least squares with econometric view regression analysis at a 5% level of significance. The analysis will involve measures such as the coefficient of determination (R^2), T-test, F-statistic, Durbin-Watson Statistic, and Probability Ratio. These measures help in evaluating the model's reliability and significance. The relationship between monetary policy and inflation in Nigeria is model as follows:

$$INF = F(MPR, BMS, EXR) \tag{1}$$

When equation 1 is transform we have the econometric form of the model as

$$INF_t = \beta_0 + \beta_1 MPR_t + \beta_2 BMS_t + \beta_3\ EXR_t + \mu_t \tag{2}$$

INF_t = inflation Rate

MPR_t = Monetrary Policy Rate

BMS_t = Broad Money Supply

EXR_t = Exchange Rate

μ_t= stochastic term or error term

β_0 = Constant or intercept

$\beta_1, \beta_2, \beta_3, \beta_4$ = Estimation parameters for the respective independent variables.

4. RESULTS AND DISCUSSION

4.1. Trend Analysis of Monetary Policy Variables and Inflation in Nigeria

Figure 4.1 presents the trend of the inflation in Nigeria from 1985 – 2020. The trend has been fluctuating from between 10 and 30% from 1985 to 1995, but has been slowly rising since then reaching a peak of 81% in 1993 followed by a decline to about 45% in 2000 and 2007. In 2010, it increased to about 25% but has fallen slightly since then and dropped to around 20% by the end of 2019. The main cause of the high inflation rates during this period was political instability and excessive government spending. However, the oil prices collapsed in 2014 resulting in a sharp drop in the cost of imported goods and thereby reducing inflation. Inflation was driven mainly by higher oil prices in the 1970s, however, since 2000, rising oil prices have boosted the economy's growth and reduced inflation (Emeru, 2020). Since the early 1980s, Nigeria's economy has experienced rapid growth due to
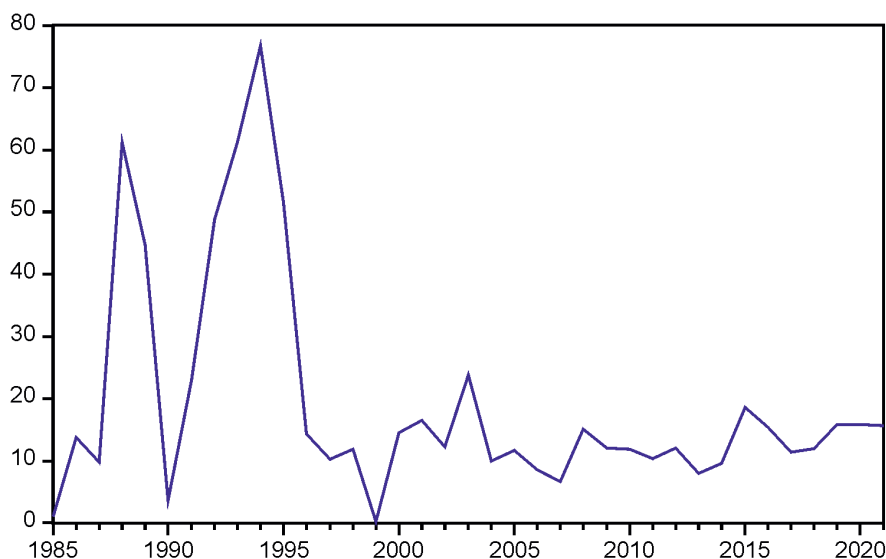
Figure 4.1: Inflationary rates in Nigeria

expanding oil production. This led to rapid increases in income per capita and levels of consumption in the 1980s. However, this growth was not sustainable in the long run as oil revenues were consumed rather than invested in the country's productive capacity. As a result, Nigeria's economic growth rate fell sharply in 2016 to 1.9% and inflation increased sharply. However, the economy recovered in 2017 with GDP growth of 2.1% and inflation falling below 9% for the first time since 2015. Growing domestic demand and strong growth in global demand helped to reduce the impact of low oil prices on the economy in 2018 and 2019. The main causes of high inflation over this period were weak domestic policy frameworks, corruption, and political uncertainty. Economic growth was expected to recover to 3.1% in 2020 and 4.1% in 2021 (Bello & Gidigbi, 2021). In December 2019, Nigeria's central bank cut its inflation forecast to 5.3% and projected 6.5% growth in 2021 and 2022 (Gbenga & Omo-Ojugo, 2022). It noted weaker economic growth in recent months and that the country's fiscal position deteriorated significantly due to the decline in oil prices. The bank also stated that the increase in government spending and other inflationary pressures had prompted the bank to take pre-emptive measures to address the high level of inflation.

Figure 4.2 presents the trend of exchange rate of Naira to the US dollars from 1985 -2020 . The figure shows that the exchange rate of Naira to the US dollars has been trending upwards since 1985. In 1995, the exchange rate was $1 = N110.0,
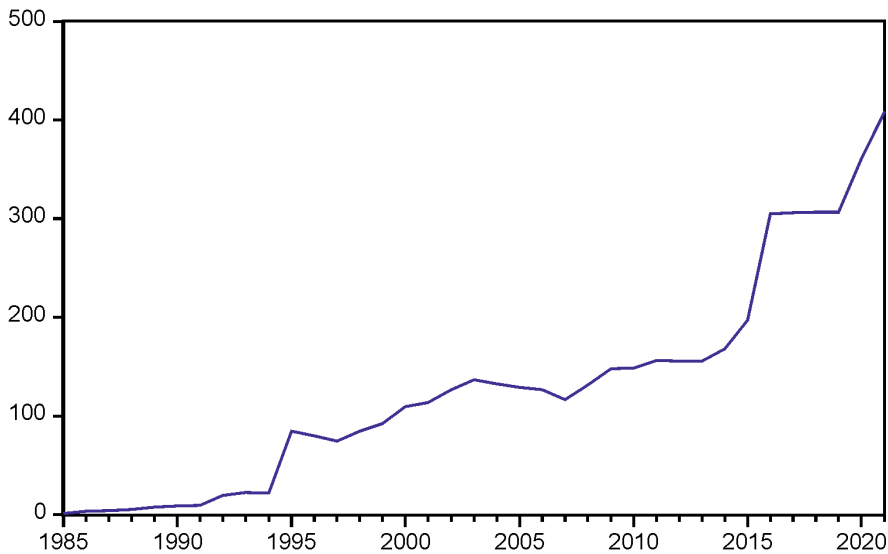
Figure 4.2: Exchange rates in Nigeria

whereas in 2020, the exchange rate was $1 = N400. This shows that the exchange rate has increased by 400% between 1985 and 2019. This increase in the value of the exchange rate can be attributed to the increase in demand for the US Dollar in Nigeria due to oil exportation (Olayeni et al., 2022). The rise in the demand for the US dollar could be because Nigeria's major export is crude oil which is supposed to be priced in US Dollars. As the oil sector of Nigeria continues to grow, the demand for the USD will continue to increase, resulting in an increase in the exchange rate of the Naira. In the short run, the exchange rate depends on supply and demand for a country's currency relative to the currencies of its trading partners. In the long run, exchange markets adjust themselves to various economic factors including interest rates and economic growth. One of the major factors that determine exchange rates is the macroeconomic fundamentals of the country in questione rate of Naira to the US dollars from 1985 -2020.

The trend of the monetary policy rates in Nigeria are presented in Figure 4.3 from 1985-2020 It depicts a downward trend for the rate starting in 1985 which continued till 2002 when the Central Bank of Nigeria started hiking the interest rates owing to rising inflation and dwindling foreign currency reserves (Figure 4.3). This trend changed after the exchange rate peg was abandoned in 2005, with the rate continuing to increase thereafter until 2014 when it started to decline slowly as the economy began to stabilize. It is projected that the rate of the policy rates
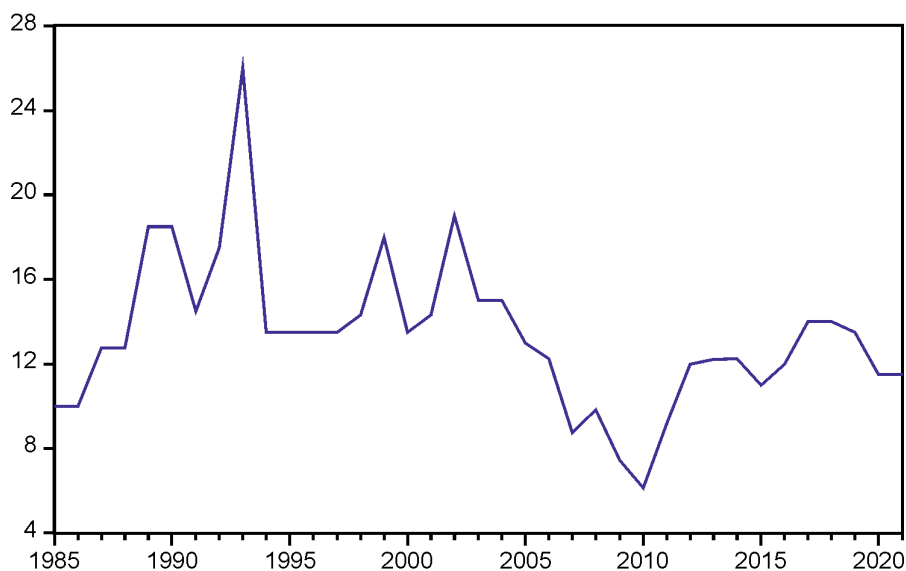
Figure 4.3: Monetary policy rates in Nigeria

will remain unchanged in the coming years as the CBN looks to keep the inflation in check and prevent currency depreciation. This will keep the interest rate high in comparison to developed economies such as the US and the UK where the rates are low (Loayza & Pennings, 2020). However, the inflation rates in Nigeria remain high due to economic problems such as poor infrastructure, unemployment and lack of resources. These economic problems are likely to continue in the next few years, leading to an increase in the money supply which in turn will lead to a rise in the level of inflation and higher interest rates. A high policy rate may increase the cost of borrowing for businesses as well as individuals and thereby slow down economic growth. Nevertheless, given the current situation and the challenges facing the country, the policy rates are expected to remain unchanged over the forecast period.

The trend of the broad money supply rate in Nigeria from 1985 – 2020 is presented in Figure 4.4 It shows a stable growth in the average broad money supply over this period, and a relatively rapid increase in the money supply beginning in about 2005, which was the period of rapid economic growth in Nigeria. This reflects the rapid growth of nominal GDP during this period, which increased significantly as a result of the economic reforms that were implemented during this period. During the period of high growth between 2009 and 2012, the money supply increased at a faster rate than nominal GDP, but this reversed during the period of low growth following the economic crisis in 2015-2016. Since then, there has been a relatively
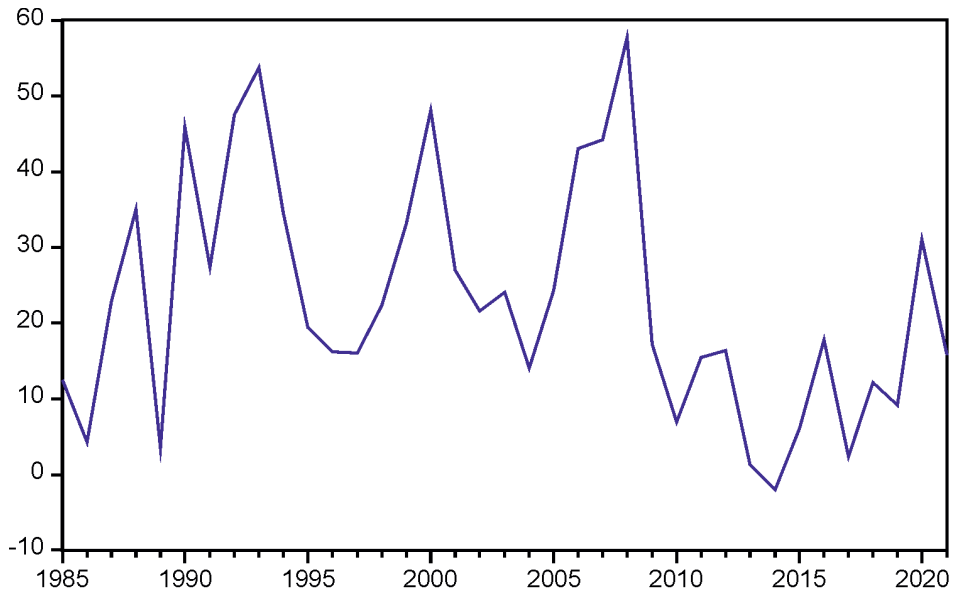
Figure 4.4: Broad Money Supply in Nigeria

stable rate of growth in the money supply as the economy recovers from the crisis (Idris, 2019). As a result, the overall level of broad money supply has increased over time, with the growth rate slightly below the rate of growth of nominal GDP. The increase in the level of broad money supply over the period has been driven mainly by the increase in the levels of M1 and M2. During the second half of the period, most of the increase was accounted for by an increase in M2, which is a reflection of the growth of the banking system as a result of improved access to credit. In the period from 2013 to 2017, this growth was driven by the increasing use of overnight call deposits, which resulted in a decrease in the share of savings accounts in the overall aggregate of liquid assets held by households and businesses. Overall, the growth of broad money supply in Nigeria has been consistent with the overall growth of economic activity in the country, although there have been periods of slower growth and periods of faster growth, as reflected in the fluctuations in the level of the monetary aggregates.

4.2. Descriptive Result

Table 4.2's descriptive statistics showed that the sample data had a normal distribution, with the mean Inflationary Rates being 19.43541, the kurtosis being 5.203655, and the standard deviation being 7131.087. The distribution's skewness was 1.796942,

Table 4.2: Relationship between Monetary Policy and inflation

	INF	MPR	EXR	BMS
Mean	19.43541	13.35514	128.8846	22.91973
Median	12.20000	13.50000	126.9000	19.41000
Maximum	76.80000	26.00000	408.6700	57.78000
Minimum	0.200000	6.130000	1.000000	-2.010000
Std. Dev.	18.11078	3.630584	107.9481	15.69999
Skewness	1.796942	1.028918	0.892031	0.529914
Kurtosis	5.203655	5.576854	3.165384	2.411135
Jarque-Bera	27.39865	16.76542	4.949100	2.266245
Probability	0.000001	0.000229	0.084201	0.322026
Sum	719.1100	494.1400	4768.730	848.0300
Sum Sq. Dev.	11808.01	474.5209	419500.3	8873.632
Observations	37	37	37	37

Source: Extracted from E-view 9.0 Output

indicating that the data were positively skewed. In the sample group, the median Inflationary Rates was 12.20. The sample data were probably normally distributed because the mean Monetary Policy Rateswas13.355, the kurtosis was 8.798378, and the standard deviation was 409.9326. The data were positively skewed, as indicated by the distribution's skewness of 2.583318. The median Monetary Policy Rates in the sample group was 5526.000. Given that the sample data had a normal distribution and that the Exchange Rates was 128.8846, the kurtosis was 3.165384, and the standard deviation was 107.9481. The distribution's skewness, which indicated how positively skewed the data were, was 0.892031. The Exchange Rates in the sample group's median fraction was 126.9. The sample data most likely had a normal distribution because the Broad Money Supply was 22.9197, the kurtosis was 2.411, and the standard deviation was 15.7. The data were positively skewed, as indicated by the distribution's skewness of 0.529914. The median Broad Money Supply in the sample group was 19.41.

4.3. Stationarity Test Result

Table 4.3: Unit Root Test for Monetary Policy and Inflation in Nigeria

	D(INF)	D(MPR)	D(EXR)	D(BMS)
ADF Statistics	-5.536747	-7.647698	-4.868312	-8.107104
1%	-3.653730	-3.632900	-3.632900	-3.632900
5%	-2.957110	-2.948404	-2.948404	-2.948404
Probability	0.0001	0.0000	0.0004	0.0000

Source: Extracted from E-view 9.0 Output

In the study, stationarity checks for economic growth and financial sector development variables were performed using the Augmented Dickey Fuller (ADF) test. The findings for each of the criteria investigated are collated and shown in table 4.3 of the prior chapter. It is clear from the table showing the results that all the monetary policy and macroeconomic votality variables were non stationary at levels but seemed stationary at the first difference. As a result, all of the series are of the first order. This is proved by the fact that all of the ADF test statistics have absolute values greater than the MacKinnon critical values at the 1% and 5% levels of significance, implying that there are no unit roots.

4.4. Co-integration Test

Table 4.4a: Unrestricted Cointegration Rank Test (Trace)

Hypothesized No. of CE(s)	Eigenvalue	Trace Statistic	0.05 Critical Value	Prob.**	
None	0.387106	40.83595	47.85613	0.1940	
At most 1	0.307860	23.70125	29.79707	0.2134	
At most 2	0.229525	10.82243	15.49471	0.2226	
At most 3	0.047308	1.696237	3.841466	0.1928	

Trace test indicates no co integrating eqn(s) at the 0.05 level
* denotes rejection of the hypothesis at the 0.05 level

Table 4.4b: Unrestricted Cointegration Rank Test (Maximum Eigenvalue)

Hypothesized No. of CE(s)	Eigenvalue	Max-Eigen Statistic	0.05 Critical Value	Prob.**	
None	0.387106	17.13470	27.58434	0.5684	
At most 1	0.307860	12.87882	21.13162	0.4634	
At most 2	0.229525	9.126189	14.26460	0.2758	
At most 3	0.047308	1.696237	3.841466	0.1928	

max- eigenvalue test indicates no co integrating eqn(s) at the 0.05 level
* denotes rejection of the hypothesis at the 0.05 level
Source: Extracted from E-view 9.0 Output

From Table 4.4 which presents the Unrestricted and Restricted Cointegration Rank Test (Trace) statistic which revealed the absence of no cointegration equations between any of the variables in the set in question. Therefore, we can deduce that each variable is standalone over time and does not move in tandem with any other variable. However, there are still some restrictions with Johansen's coefficient; it only returns statistics which are restricted to the level that the variables are constant over time. This means that if the variable in question is not constant over time then the test

will not return any results. This will prohibit the test from revealing any correlation between two variables when there are changes in their underlying dynamics. The results shown in Table 4.4 therefore indicate that the data used does not constitute a cointegrated system as there are no continuous relationships between any of the variables under investigation.

4.5. Vector Autoregression Result

Table 4.5: Relationship between Monetary Policy and Inflation in Nigeria

	INF
INF(-1)	0.706793
	(0.18553)
	[3.80957]
INF(-2)	-0.269369
	(0.16801)
	[-1.60332]
C	10.13519
	(12.7303)
	[0.79615]
MPR	-0.004699
	(0.79401)
	[-0.00592]
EXR	-0.028446
	(0.02747)
	[-1.03557]
BMS	0.211902
	(0.17536)
	[1.20840]
R-squared	0.481918
Adj. R-squared	0.392594
Sum sq. resids	5915.748
S.E. equation	14.28255
F-statistic	5.395145
Log likelihood	-139.4383
Akaike AIC	8.310759
Schwarz SC	8.577390
Mean dependent	20.12600
S.D. dependent	18.32594

Source: Extracted from E-view 9.0 Output

The choice of the Vector Auto Regression model is prompted by the reason that the variables are ordered according to an expected effect. The order suggests that

the variables are related in a causal way. The vector autoregression results in Table 4.5 indicates that the model is statistically fit with an F-Statistic value of 5.395, and the R^2 value of 0.482 indicates that the independent variables account for 48.2% of the total variation in the dependent variable. Inflation in the first lag was statistically significant at 5% positively related to inflation which implies the relationship that the higher the initial inflation the higher the future inflation levels would be. The second lag of inflation was statistically significant at 4% negatively related to inflation which implies that the higher the initial inflation the lower the future inflation levels would be, or the higher the current inflation is the higher the later inflation levels are (Hooper et al., 2020). Monetary policy rate and exchange rate were not statistically significant but negatively related to inflation which suggests that higher these variables are in the future interest rates are lower and vice versa meaning that if interest rates rise monetary aggregates will follow raising inflation while the reverse except for broad money supply.

5.   CONCLUSIONS

The study has undertaken a comprehensive analysis of the impact of monetary policy on macroeconomic volatility in Nigeria. It utilized a quasi-experimental approach, combining theoretical frameworks and empirical observations. The data spanned from 1985 to 2021, encompassing key monetary policy indicators such as money supply, monetary policy rate, interest rate, and exchange rate. The findings indicate several noteworthy insights. Firstly, it was observed that all of monetary policy and macroeconomic volatility variables were non-stationary at levels but became stationary at the first difference. This suggests that the variables exhibit a certain level of stability over time. However, the absence of cointegration equations between any of the variables indicates that each variable operates independently without moving in tandem with others. The Vector Auto regression model was employed to analyze the relationships between the variables. The results demonstrated a statistically significant fit of the model, with the monetary policy variables accounting for 48.2% of the total variation in the macroeconomic volatility. Inflation in the first lag was found to be positively related to future inflation levels, indicating a certain level of persistence in inflation rates. Additionally, the second lag of inflation was negatively related to inflation, suggesting a dampening effect on future inflation levels. While the monetary policy rate and exchange rate were not found to be statistically significant, they displayed a negative relationship with inflation. This implies that higher values of these variables in the future are associated with lower interest rates.

This relationship underscores the complex interplay between monetary policy tools and macroeconomic dynamics in Nigeria. Based on the findings of this study, several recommendations were put forth as follow

(i) Enhanced Data Analysis: Further research could benefit from a more granular analysis of specific sectors within the economy to better understand the nuanced impacts of monetary policy.

(ii) Policy Coordination: Given the interconnectedness of various economic variables, policymakers should consider a holistic approach that combines both monetary and fiscal measures for effective stabilization.

(iii) Continuous Monitoring: Regular assessments of the effectiveness of monetary policy tools are crucial for timely adjustments and fine-tuning of strategies to address evolving economic conditions.

(iv) Research on Exchange Rate Dynamics: A deeper exploration into the relationship between exchange rates, interest rates, and inflation could provide valuable insights for policy formulation.

(v) Incorporate External Factors: Future studies may consider incorporating external factors such as global economic trends, trade dynamics, and geopolitical events to provide a more comprehensive analysis.

(vi) Longitudinal Studies: Conducting longitudinal studies over extended periods could offer valuable insights into the long-term effects of monetary policy on macroeconomic stability in Nigeria.

(vii) In conclusion, this study has shed light on the complex dynamics between monetary policy tools and macroeconomic variables in Nigeria. By leveraging these findings, policymakers can make informed decisions to enhance economic stability and foster sustainable growth. However, it is imperative to acknowledge that economic environments are dynamic, and continued research and adaptability in policy implementation are crucial for achieving enduring stability.

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