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An Empirical Analysis of the Relationship between Key Macroeconomic Variables and Economic Growth in Nigeria (1980-2021)

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Abstract
This study adopts the Vector Autoregressive (VAR) model to analyze the relationship between key macroeconomic variables and economic growth in Nigeria, Using time series data sourced from the World Bank Development Indicators (WDI), for the period 1980 to 2021. The key macroeconomic variables analyzed are inflation, exchange rate and money supply. The result gives an average high R2 of 0.7000 which connotes that the overall model is a good fit. The result of the VAR analysis at lag two indicates that the variables are dynamically interacted. Starting with the growth (GDP) equation, a 1% increase in the previous year values of exchange rate, GDP, inflation, and money supply lead to a 0.3% increase, 33% increase, 3% increase, and 26% increase in current GDP respectively. Here, GDP and money are positively related. The money supply shows that a 1% increase in the previous year values of exchange rate, GDP, inflation and money supply lead to a zero per cent decrease, 8% decrease, 7% decrease and 91% increase in current money supply. The result is consistent with monetary policy given that the relationship between money supply and inflation. The equation of inflation shows that a 1% increase in the previous year values of exchange rate, GDP, inflation and money supply lead to 9% decrease, 33% decrease, 68% increase and 15% increase in the current level of inflation. The consequences of a growing inflation and high exchange rate phenomenon are so damning that Nigeria cannot afford them. Such implications are glaring in the economy of Nigeria where many negative developments were traceable to the non-availability or insufficiency of foreign exchange for businesses especially small and medium enterprises (SME's) with a frequent rise in general price level. Therefore, the need to aptly address this ugly development by the monetary and fiscal authority cannot be overemphasized.
Keywords: Money supply; economic growth; VAR model, Inflation and exchange rate.
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1.0 Introduction

Economic growth, and its relationship with some key macroeconomic variables such as monetary aggregates (money supply), inflation rate and Foreign Exchange rate has continued to be a key area of discussion globally including developing countries like Nigeria. The empirical literature regarding the effect of exchange rate volatility on economic growth is unsettled and reviewing literature concern on channels where the exchange rate volatility affects the real economy is crucial. As it is mentioned by Schnabl (2008), the three channels where exchange rate volatility can enhance economic growth are international trade, foreign direct investment, and macroeconomic stability. High economic growth is expected to improve people's lives through an increase in employment opportunities and reduction in poverty. Economic growth also has close links with the financial sector. In other words, the ratio of the money supply and real lending interest rate can ensure economic growth through productive investment projects implementation. The relationship between money supply and economic growth has been receiving increasing attention than any subject matter in the field of monetary economics in recent years. Economists differ on the effect of money supply on economic growth.

While some agreed that variations in the quantity of money is the most important determinant of economic growth and that countries that devote more time to studying the behaviour of aggregate money supply experiences many variations in their economic activities (Handle 1997 as cited in Nwankwoeze, 2012), others are skeptical about the role of money on gross national income (Robinson 1950, 1952 as cited in Nwankwoeze, 2012).

In discussing the concept of money supply and its impacts, two other issues often come to our mind which is the state of inflationary pressure and the exchange rate. According to the monetarist, an increase in money supply in an economy causes an increase in general price level of commodities which brings about inflationary pressure in the country (Uzougu 1981 as cited in Nwankwoeze, 2012). The question that arises is whether there is a two-way causal relationship between the financial sector and economic growth. The proxies used to describe the state of economic growth are GDP and index of producers (IP).

It is obvious that money used normally in all the economic transactions has powerful effect on economic

activity. Thus, increase in supply of money will result in decrease in interest rates and increase in investment. In this way, when extra money is spread in the society, the consumers feel richer and will spend more. Industries acknowledge enhancement by ordering more raw materials and increase their production. When the business flourish, the demand for labour and capital goods will increase. Stock market prices increase, and firms issue more equity and debt. In this perspective, money supply continuous to expand. Prices begin to rise if output growth meets capacity limits. People began to expect inflation, lenders demand higher interest rates, consumer purchasing power decreases over the life of their loans.

Money supply influences or affects Economic growth positively or negatively. From 1959, there have been two major phases in the pursuit of monetary policy, namely: direct monetary control phase and the market mechanism phase. These phases were all aimed at regulating the supply and cost of money optimally such that certain desired national objectives such as increased and sustainable output were achieved. It has been observed that the quantity of money supplied in an economy influences the Gross Domestic product or output overtime. For instance, Sanusi (2001) asserts that lags in economic growth over time are caused by capital inadequacy traceable to the failure of monetary policy amongst other factors. Odedokun (1994) also asserts that financial intermediation promotes economic growth. Could this therefore imply that money supply affects economic growth in Nigeria? If it affects economic growth, does it still have influence economic growth of Nigerian beyond the SAP period? In the light of this, the study aims to examine the nexus between some key macroeconomic variables and economic growth of Nigeria between 1980 to 2021, representing a period of post deregulation of economic activities in Nigeria. Thus, the key macroeconomic variables which shall be the focus of this study are; Money supply, Inflation, exchange rate and economic growth as represented by growth in Gross domestic product.

The objective of this paper is to investigate the relationship between inflation, money supply, exchange rate and economic growth in Nigeria economy for the period 1980 – 2021.

The remainder of the article is divided into the following sections: (II) literature review, (III) data and methodological framework, (IV) estimation of results, and (V) Conclusion and recommendation.

2.0 Literature review

Many studies have been done to explain the relationship between inflation, money supply, exchange rate, and economic growth. It is obvious that every economy in the world has a certain amount of money in circulation which enhances economic activities and if it is in excess, it has the capacity to influence the economy adversely. At this juncture, different studies are reviewed.

2.1 Inflation and Economic Growth

However, there have been different views on the relationship between inflation and economic growth especially with respect to the nature of the relationship and the direction of causation. There is the structuralists' view that inflation is good for growth and the monetarists' belief that inflation is harmful to economic growth. Researchers have embarked on empirical analysis to determine evidence have been given, first is that inflation has a positive relationship with economic growth; secondly is that inflation has a negative relationship with economic growth. The issue of causality between these variables has also been a cause for research in many studies, which has also been proved to be different across countries. Fischer (1993) argued that, while inflation is negatively associated with economic growth, the direction of causality remains unclear (Fischer, 1993).

Fischer (1993) in his research confirms a non-linear relationship between inflation and economic growth. Evidence has shown that inflation reaches a certain point or level where a positive effect on growth becomes negative (Fischer, 1993). Fischer's findings have triggered researchers to investigate the turning point, at which inflation becomes harmful to growth. As put by Khan and Senhadji (2001) that for most countries, maintaining a stable economy with low inflation coupled with a high and sustained output, is one of the major macroeconomic objectives. The estimation of inflation threshold is useful to policy makers in formulating policies that will keep the inflation rate below the threshold, thus evading the negative effects. Studies have come up with different inflation threshold levels for specific countries, for developing countries and industrialized countries.

Mkhatshwa et al (2015) carried out an analysis of the relationship between inflation, economic growth and agricultural growth in Swizaland using the ARDL methodology between 1980-2013. The existence of long-run relationship and causality were tested. A long-run relationship between these variables was found to exist. Granger causality results show that, in 1980-2013, there was uni-directional causality in Swaziland that flows from economic growth to inflation, no causality was detected between economic growth and agricultural growth, and between inflation and agricultural growth. Using the non-linear model, Swaziland's inflation threshold was estimated at 12.56% with respect to economic growth and 10.36% with respect to agricultural growth. The elasticities from the long-run and short-run regressions showed that inflation has a negative impact of about 2% in the long-run on the economy and impacts positively by about 0.05% in the short-run. In the short-run, the agricultural growth has a positive relationship with the economic growth in Swaziland, with an influence of 15% on economic growth. Based on their findings, they recommended that the Government promote the agricultural

sector and that the monetary authorities in Swaziland Government pay more attention to the inflation trend and pursue policies that will ensure single digit inflation.

Adaramola, A. O., & Dada, O. (2020) examined the Impact of inflation on economic growth in Nigeria for the period 1980-2013 using ARDL on selected variables such as real gross domestic product (GDP), inflation rate, interest rate, exchange rate, degree of economy`s openness, money supply, and government consumption expenditures. The findings indicate that inflation and real exchange rate exert a significant negative impact on economic growth, while interest rate and money supply indicate a positive and significant impact on economic growth. Other variables in the model depict no influence on the economic growth of Nigeria. The causality result shows the unidirectional relationships between interest rate, exchange rate, government consumption expenditures and gross domestic product. However, inflation and the degree of openness show no causal relationship with gross domestic product. As a result, it was recommended that a more pragmatic effort is needed by the monetary authorities to target the inflation vigorously to prevent its adverse effect by ensuring a tolerable rate that would stimulate the economic growth of Nigeria.

In Latin America, Manoel (2010) examines how the inflation rate affects the growth of the country employing panel estimation techniques on data sets from 1970 to 2007 among four Latin American countries. The study uses the growth rate of real GDPs made as a function of inflation, the contributions of government's share in GDP, trade openness, investment ratio, structural development index, the proportion of liquid liabilities to GDP, and political regime. From the result, inflation and the growth of the economy depict significant negative relationship.

In South Africa, using ordinary least squares (OLS) estimation techniques on quarterly data from February 2000 to July 2010, Phiri (2010) conducts a study on the inflation level that could be considered harmful to growth-financing activities. The variables for the analysis are real gross domestic product, inflation rate, capital accumulation, lending capacity of banks, equity trade volume, and exchange rate. The result indicates that inflation depicts an adverse effect on growth-financing activities in South Africa at all levels.

Mamo (2012) conducts a study among 13 Sub-Saharan Africa (SSA) countries from 1969 to 2009 on how inflation affected the economic growth. The study employs panel regression on variables, which include inflation, investment, population, and gross domestic product. The study shows that the inflation rate and economic growth are inversely related, while Granger causality reveals that the inflation rate in the country can be used to predict the growth rate among countries. Kasidi and Mwakanemela (2015) analyzed the influence of inflation on the economic growth for the period 1990–2011 in Tanzania using correlation and co-integration techniques, and state that no strong relationship exists between inflation rate and the growth of their economy.

Employing Johansen co-integration and Granger causality test, Denbel et al. (2016) investigate if there is any relationship among money supply, inflation, and economic growth in Ethiopia. The results from Johansen co-integration support the work of Mkhatshwa et al. (2015), while the direction of causality indicates that its runs from economic growth to inflation rate and from money supply to economic growth.

Al-Taeshi (2016) examines how inflation impacts Malaysian economy from 1970 to 2014 using co-integration and Granger causality test. Evidence from the study suggests that inelastic response was found between economic growth and inflation rate. Using the panel analysis, Ndoricimpa (2017) studies inflation threshold on economic growth in some selected African countries. The result indicates the nonlinear relationship between the two variables, and that low inflation enhances the growth of the economy in the middle-income countries, while it has no effect on the sample put together. The result also shows that inflation beyond the threshold negatively influences the economy in all the countries.

In Nigeria, investigating budget deficit and economic growth is causally examined by Oladipo and Akinbobola (2011) using the growth of the economy, inflation rate, budget deficit, and exchange rate. The study shows unidirectional causal relationship between deficit budget and inflation rate and that it runs from the former to the latter. The result also reveals that budget deficit affects inflation rate as a result of frequent fluctuations in the exchange rate.

Umaru and Zubairu (2012), using regression analysis and causality estimation test on data ranging from 1970 to 2010, examine how inflation impacts on the Nigerian economy. The result shows unidirectional relationship between gross domestic product and rate of inflation, while there exist the causal relationships between the former and the latter. The result also indicates that inflation reveals positive influence on the growth of the economy.

Inyiama (2013) employs Johansen co-integration and Granger causality test to determine if inflation weakens the growth of Nigerian economy for the period 1979–2010. The result shows that the rate of inflation is inversely related on economic growth, while the exchange rate and interest rate indicate a direct impact on the economy. The causality test indicates no causal relationships between inflation rate and economic growth.

Ogbonna (2014) employs vector error correction model (VECM) estimation to examine the government size and the dynamics of inflation in Nigeria for the period 1981–2013. The results indicate long-run relationship between government size and consumer price index, while there is no causal relationship between the two variables, and that consumer price index in Nigeria is affected by its lagged value and current period of exchange rate of the domestic currency.

Anochiwa and Maduka (2015) determine if any relationship can be found between the growth of the economy and inflation rate in Nigeria during 42 years (1970–2012). The results of Johansen co-integration test reveal the nonlinear negative influence between the two economic variables, while Granger causality indicates no causal relationship between them.

Chude and Chude (2015) employ time-series data from 2000 to 2009 using ordinary least squares regression estimation technique to examine the influence of inflation on economic growth of Nigeria. The result indicates the positive and significant relationship between inflation, exchange rate and growth of the economy. Olu and Idih (2015), using least squares method, analyze the influence of inflation on economic growth of Nigeria from 1980 to 2013. The result shows an insignificant positive relationship between two variables.

Shuaib et al. (2015) employ co-integration and Granger causality tests to examine how inflation rate affects the economy of Nigeria for the period 1960–2012. The result reveals no long-run relationship in the model, while causality test also indicates no causal relationship among the variables. Enejoh and Tsauni (2017) examined how inflation rate affects the country's economy using ARDL techniques and Granger causality during 47 years (1970–2016). The result indicates that inflation rate and exchange rate have a positive impact on economic growth, while the lagged value of exchange rate indicates a negative relationship with the growth of the economy. The causality test shows no causal relationship between inflation rate, exchange rate and the growth of Nigeria economy.

Anidiobu et al. (2018) determine the influence of inflation on the economic growth of Nigeria using descriptive and ordinary least squares on the data for the period 1986–2015. The result indicates that inflation rate depicts an insignificant positive relationship, exchange rate shows a significant positive relationship, while there is a negative insignificant relationship between interest rate and growth of Nigeria economy.

In a similar study, Idris and Suleiman (2019) investigate the influence of inflation on economic growth of Nigeria from 1980 to 2017. The study employs vector error correction mechanism on variables selected, which are gross domestic product, inflation rate, interest rate, and exchange rate in the country. Findings reveal longrun relationship among the variables and that inflation rate and interest rate affect the economic growth of Nigeria significantly and negatively in the long run.

Following all these empirical studies, it is evident that consensus has not been reached on the subject matter. This has actually paved the way for this study to justify the types of relationship and the direction of causality among variables selected for this study.

2.2 Money Supply and Economic Growth

Bednarik (2010) employed Vector Autoregressive (VAR), Johansen Cointegration method, and Granger-Causality test to analysis the relationship between money supply (M3) and real GDP in the Czech Republic, by using quarterly data for the period 2002 to 2009, and conclude that whether the quantitative theory of money holds in Czech Republic, there is indeed strong and mutual relationship between money supply and real GDP.

Zapodeanu and Cociuba (2010) explored linking money supply with the gross domestic product in Romania by using the data of gross domestic product (GDP), and broad money (M3) and the monetary aggregates M1 and M2 during period of 1999 to 2010 were collected. Analyzing in Romania used the DVAR model for linking between the two sets of data types, used Co-integration analysis for testing two series to have a cointegration relationship between them. The result show that there is a cointegration between them, and found that The DVAR model is the best model for explicating the link between two variables.

Ogunmuyiwa and Ekone (2010) investigated the impact of money supply and economic growth Nexus in Nigeria by using data during 1980 to 2006, and employed econometric technique OLS estimator, Causality test and Error Correction model to time series data. The results suggest that money supply do not have a significant predictive power in explaining the growth of real GDP on both of the choice between contractionary and expansionary money supply.

Ihsan and Anjum (2013) has examined the impact of money supply (M2) on the GDP of Pakistan, due to high rate of inflation has adversely affected the economy of Pakistan which is a result of excessive supply of money (M2) by SPB. They have taken into consideration the data for 12 years from 2000 to 2011, and analyzed this data by using the regression model. In this model, they have taken three independent variables that are inflation rate, interest rate and CPI and one dependent variable that is GDP. They found that the CPI and interest rate have a significant impact on GDP, and inflation rate has insignificant impact on GDP.

Holod (2000) investigates the identified vector autoregression to model the relationship between CPI, money supply and exchange rate in Ukraine. The results show that exchange rate shocks significantly influence price level behaviour. Further, the study also found that money supply responds to positive shocks in price level. The study contributes to the sizable literature on IT using overly sophisticated vector error correction model with complex identification structure. There is however an element of data mining in the generation of impulse response functions.

According to Umeora (2010), Money Supply is the life wire of all economic activities and so has powerful effects on the economic life of any nation. An increase in Money Supply puts more money in the hands of

producers and consumers and thereby stimulating increased investment and consumption. Consumers increase purchases and business firms respond to increased sales by ordering for more raw materials and other resources to achieve more production, the spread of business and capital goods. As the economy goes buoyant, Stock Market prices rise and firms issue more equity and debt instruments. As the Money Supply expands, prices begin to rise, especially if output growth reaches full capacity. Lenders insist on higher interest rates to offset expected decline in purchasing power over the life span of their loans. Opposite effects occur when the Money Supply falls or when there is decline in its growth rate, economic activities decline and disinflation (reduced inflation) or deflation (falling price) results.

Grauwe and Polan (2005) use a sample of about 160 countries over a sample of 30 years to examine relationship between growth, money and inflation. They find a strong positive but unproportional relation between long-run inflation and the money growth rate on economic growth. They argue that the strong link between inflation and money growth is almost wholly attributable to the presence of high-(or hyper-) inflation countries in the sample.

Obaid (2007) tests the causality relationship between money supply (M3) and real GDP in Egypt during the period (1970-2006), by using Granger test. He concludes that there is no causality between the nominal money supply and nominal GDP during the study period, while when he used the real money supply and real GDP, he finds that there is mutual causality relationship between real money supply and real GDP in Egypt (non-neutral money), and thus the monetary policy is an effective policy on the real GDP in Egypt, the mutual causality relationship could help to forecast the GDP behaviour within assumed volume of money supply by the economics policy making in Egypt

El-seoud (2014) tested the relationship between money supply and GDP in Bahrain for the period of 13years. Using Cointegration, Error Correction model and granger causality techniques, the findings reveal the existence of a long run equilibrium between real GDP and real money supply while the Error term and F-test indicate unidirectional causality running from real GDP to real money supply in the short run as well as in the long run.

Xie, Tang, Cui (2009) in an empirical analysis on the relationship between money supply, economic growth, and inflation in China from 1998 to 2007 with cointegration and Granger causality test approaches shows that there is no cointegration relationship among money supply, inflation, and economic growth, but there is cointegration relationship between money supply and inflation while there is no long run relationship between money supply and economic growth. Thus, they conclude that there is a contradiction between the goal of economic growth and of price stability in China. There finding and conclusion implies that it may be possible to implement loose monetary policy contemporaneously, there is still the need to explore other sources that can stimulate economic growth other than monetary policy in the long run.

Empirical studies on the possible sources of the inflationary situation in Ethiopia indicated that, the fast increase in broad money supply, the widening of public budget deficit and the mechanism of financing it, the rise in price of oil and food items and other as the causes of the price surge (ADB, 2011; Jema and Fekadu, 2012).

Desta, (2009) stated that, there was an increase in broad money supply in Ethiopia and bank credit has been increased. From 2002 to 2006, Ethiopia's real GDP increased by 6.8 percent. Rather than adjusting the money stock with the change of GDP, the country's money supply grown by about 18 percent, contributing to an average 12 percent increase in the rate of inflation. He also argues that if a nation achieves full employment, it is possible to assume that economic growth is likely to precipitate an inflationary situation. However, Jema and Fekadu, (2012) analyzed determinates of the recent soaring food inflation in Ethiopia and stated that, in Ethiopia food price accounts for the lion's share of the Consumer Price Index. This results in food price inflation necessitating general inflationary pressures in the economy both directly and indirectly. Moreover, food prices increased even faster than non-food items that made it the main contributor to high general inflation.

Kesavarajah and Amirthalingam, (2012) examined the nexus between money supply and inflation in Sri Lanka over the period 1978 to 2010. They employed Johanson and Juseliues multivariate cointegration test and Granger causality test to estimate the long run equilibrium relationship among the variables.The result indicates the presence of long run relationship among the variables and the Granger causality test indicates there was a significant causality from money supply to inflation in Sir Lanka.

Amin, (2011) studied "Quantity Theory of Money and its Applicability" in the case of Bangladesh using Johansen cointegration method; the empirical findings indicate the existence of long run cointegrating relationship between money supply and inflation. The Granger causality test, revealed a unidirectional causal relationship running from money supply to inflation which provides evidence in support for quantity theorist's view.

Abbas and Husain, (2006) examined the causal relationship between money and income and between money and prices in Pakistan. Their cointegration analysis indicates that the existence of long run relationship among money, income and prices. The causal relationship between money and prices indicated a bi-directional causality that money expansion increases price level and inflation in turn increases the money supply in Pakistan.

Chimobi and Uche, (2010) studied the relationship between Output, Money and Inflation in Nigeria by employing Cointegration and Granger-causality test analysis. Their findings revealed non-existence of a

cointegrating vector in the series used. Money supply was found granger cause both output and inflation. The result implies that monetary stability can contribute towards price stability in the Nigerian economy.

Tabi and Ondoa, (2011) analyzed the relationship between economic growth, inflation and money in circulation in Cameroon using a VAR model for the period 1960-2007. They found that increase in money supply increases growth and that growth causes inflation; however, an increase in money supply does not necessarily increase inflation.

In Tanzania, Ailkaeli, (2007) studied Money and Inflation Dynamics in Tanzania. He used GARCH model on seasonally adjusted monthly data for the period 1994-2006 and the results of the study shows that, a current change in money supply would have impact on inflation rate significantly in the seventh month ahead.

Hossain (2005) studied the causal relationship among the money growth, inflation, currency devaluation and economic growth in Indonesian context. In his study, the time series data were employed during the period of 1954 to 2002 and the multiple regression method was utilized to test the relationship among the Independent and dependent variables. This study found that there was positive relationship among the dependent and independents variables.

Sims (1972) scrutinized the relationship between the money supply and the output of USA. This study found that the money supply helps in the interpretation of output and not the opposite. It means that there was causality relationship from the money supply to gross domestic product. Seoud and Abou (2014) examined the relationship between money supply and gross domestic product of Bahrain using the time series data for the periods of 2000 to 2013. In this study the ADF, the Engel Granger two steps cointegration test, the error correction mechanism were used to examine the relationship between the money supply and the gross domestic product. This study determined that the money supply and the gross domestic product were cointegrated at 1st difference level I(1). And the Granger causality test showed that there was unidirectional relationship from the real gross domestic product to the money supply in the short run as well as the long run periods.

Lashkary and Kashani (2011) studied the impact of Monetary Variables on Economic Growth in Iran. To test the relationship between these variables, this study used time series data from the period of 1959 to 2008 support of the following variables such as employment, real economic growth, real money volume, real growth rate of government expenses, growth rate of oil revenues and exchange rates. In this study the OLS econometric technique was used to test the relationship between dependent and independent variables. Based on this analysis, this study found that the money volume was not significantly impact on economic growth of Iran. In the meantime, Nouri and Samimi (2011) examined the impact of monetary policy on economic growth in Iran. This study used annual time series data during the period of 1974 to 2008. To test the impact of monetary policy the econometric OLS method was employed. At last, this study explored that the money supply was positively impact on economic growth of Iran.

Ogunmuyiwa and Francis (2010) explored the impact of money supply on economic growth on Nigerian economy. The time series data from 1980 to 2006 were utilized to test the impact of money supply. The money supply has positive impact on economic growth at 5% significant level. In this study the OLS econometric techniques was employed. In accordance with results, even though money supply affects positively on economic growth, but it has no significant impact on economic growth.

Ikechukwu (2012) explored the impact of money supply on economic growth of Nigeria with the help of secondary data during the period of 1981 to 2010. This study used the following variables such as the real gross domestic product, the real exchange rate, the broad money supply, real interest rate to test the impact of money supply. Eventually, the above study delivered its conclusion that the all respective variables were insignificantly impact on the real gross domestic product except the money supply which was statistically significant on the economic growth of Nigeria.

Ogunmujiwa and Ekone (2010) studied monetary supply economic growth Nexus in Nigeria. This study investigated the impact of money supply on economic growth in Nigeria from 1980 to 2006. Applying economic growth in Nigeria from causality test and E.C.M. to time series data, the results revealed that although money supply is positively related to growth but the result is however insignificant in the case of GDP (Gross Domestic Product) growth rates on the choice between contractionary and expansionary money supply.

Ashra et al. (2004) examines the relationship between money supply and economic growth for the case of a developing country, that is, Indian and indicates that there exists bi-directional causality between money and price level and that money is non neutral so that is not exogenous in the long run.

Abbas and Husian (2006) examine the casual relationship between money and income and money and prices in Pakistan. The co-integration analysis indicates, in general, the long run relationship among money, income and prices. The error correction and Granger causality framework suggest a one-way causation from income to money in the long run implying that probably real factors rather than money supply have played a major role in increasing Pakistan's national income, regarding the causal relationship between money and prices, the causality frame work provides the evidence of bivariate causality indicating that monetary expansion increases and is also increased by inflation in Pakistan. However, money supply seems to be the leader in this case.

Asogun (1998) examined the influence of money supply and government expenditure on gross domestic product. He adopted the Saint Louis model on annual and quarterly time series data from 1960-1995. He finds money supply and export as being significant on the determinant of economic growth in the Nigerian economy. The result indicated that unanticipated growth in money supply would have positive effect on output.

Mohammed et al. (2009) examines the long run relationship among M2, inflation, government spending and economic growth in Pakistan by using annual time series data from 1977 to 2007. Co integration results shows that public expedition and inflation has significant and negative effect while M2 has significant and positive effect on economic growth in the long run.

Wolde–Rufael, (2008) tried to investigate the causal link among inflation, money and budget deficits for the period 1964 to 2003 using the bounds test approach to co integration and a modified version of the Granger causality test. While, Fekadu, (2012) analysed the relationship between inflation and economic growth for the period 1980-2011 using Vector Auto regression (VAR) model. In this study the relationship between money supply, inflation and economic growth in Nigeria, using VAR model will be examined.

3.0 Data, Theoretical and Methodological framework

3.1 Data and Study variables

The data set used in this paper refers to yearly time series data covering the period 1980 to 2021. The data used for the study were sourced from the World Development Indicators of the World Bank. The variables used for the study include the economic growth rate (GDP), exchange rate, money supply and inflation.

Table 3.1 Variables, Sources and Expectations

Variables	Expectation	Source
GDP growth rate	Positive	World Bank Development Indicators (2021)
Inflation (INF)	Negative	World Bank Development Indicators (2021)
Money Supply (MS)	Negative	World Bank Development Indicators (2021)
Foreign Exchange (EX)	Positive	World Bank Development Indicators (2021)

3.2 Theoretical Framework

The quantity theory of Money (QTM) has its roots in the 16th century during which classical economists such as Jean Boldin at that time sought to know the cause of the increases in French prices. He concluded that, among other factors, increase in gold and silver which served as currencies were responsible for the rise in the demand for French-made goods and, hence, French prices, thus linking movements in prices to movements in money stock. By the 1690s, the quantity theory was further advanced by John Locke to examine the effects of money on trade, the role of interest rate and demand for money in the economy. In particular, the role of money as a medium of exchange to facilitate trade transactions was born. Economists at the time inferred that the quantum of money needed for such transactions would depend on the velocity of money in circulation and the relationship between the demand and supply of money such that where there was excess demand over supply interest rates rose and vice versa (Cantillon, 1755; Locke 1692 as cited in Ajuzie, et al, 2008).

Modern classical economics school of thought, which has come to be known as the monetarists, continues in the same light as the early economists and is often concerned with explanations for changes in price level. To them, a stable and equilibrating relation exists between the adjustments in the quantity of money and the price level. The more orthodox monetarist assumes that a rise in the quantum or variation in money supply determines the value of money, but not necessarily changes in output. In other words, they refute any form of monetary influence on real output both in the short-and long-run. This led to the popular paradigm that, “Inflation is always and everywhere a monetary phenomenon”. For the less stringent monetarist, they agree that money influences output in the short-run, but only prices in the long-run. Nevertheless, irrespective of the path of adjustment, the monetarist all seem to concur that in order to reduce or curtail inflationary growth, money growth should be less than or equal to the growth in output.

The quantity theory of money is hinged on the Irvin Fisher equation of exchange that states that the quantum of money multiplied by the velocity of money is equal to the price level multiplied by the amount of goods sold.

It is often replicated as MV= PQ, M is defined as the quantity of money, V is the velocity of money (the number of times in a year that a currency goes around to generate a currency worth of income), P represents the price level and Q is the quantity of real goods sold (real output). By definition, this equation is true. It becomes a theory based on the assumptions surrounding it.

The first assumption is that velocity of money is constant. This is because the factors, often technical, habitual and institutional, that would necessitate a faster movement in the velocity of money evolve slowly. Such factors include population density, mode of payment (weekly, monthly), availability of credit sources and nearness of stores to individuals. This assumption presupposes that the velocity of money is somewhat independent of changes in the stock of money or price level. However, the Keynes liquidity preference theory suggests that the speculative

components of money demand affect money velocity. Friedman in his modern theory of the quantity theory of money further explores the variables that could affect the velocity of money to include human/nonhuman wealth, interest rate, and expected inflation.

The second assumption guiding the QTM is that factors affecting real output are exogenous to the quantity theory itself. In other words, monetary factors do not influence developments in the real economy.

The third assumption states that causality runs from money to prices. Thus, the quantity theory of money can be represented as MV →PQ. In simple terms, this states that prices vary proportionally in response to changes in the quantum of money, with velocity and real output invariant.

3.3 Methodology, Model Specification and Apriori Expectation

The main objective of this study is to establish the relationship between money supply, Inflation and Economic Growth in Nigeria. It is assumed that economic growth is simultaneously determined by monetary factors as represented by money supply and by real factors such as inflation. The volume of money in circulation is a function of the rate of growth of the GDP and government expenditure. Inflation (INF) is a monetary phenomenon following monetarist viewpoint and quantity theory of money. An increase in money supply (MS) should lead to an increase in general price level. Also, an increase in money supply can also lead to a boost in economic activities by the various economic agents. It is therefore established that the relationship between money, the general price level (proxy for inflation), foreign exchange rate (FX) and the growth of GDP (economic growth) can be represented by the following VAR functional relationship:

$$\mathrm{GDP_t} = f(\mathrm{MS_t}, \mathrm{INF_t}, \mathrm{EX_t}) \ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots (1)$$
$$\mathrm{MS_t} = f(\mathrm{GDP_t}, \mathrm{INF_t}, \mathrm{EX_t}) \ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots (2)$$
$$\mathrm{INF_t} = f(\mathrm{MS_t}, \mathrm{EX_t}, \mathrm{GDP_t}) \ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots (3)$$
$$\mathrm{EX_t} = f(\mathrm{GDP_t}, \mathrm{INF_t}, \mathrm{MS_t}) \ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots (4)$$

In the above functional relationship, exogenous variables can influence endogenous variables both at times t and at time t-1, the above functional relationship is therefore specified in a VAR model, which can be presented by the functional relationship below:

$$GDP_t = \sum_{j=1}^{p} \alpha_{1j}\, GDP_{t-j} + \sum_{j=1}^{p} \alpha_{2j}\, MS_{t-j} + \sum_{j=1}^{p} \alpha_{3j}\, INF_{t-j} + \sum_{j=1}^{p} \alpha_{4j}\, EX_{t-j} + \varepsilon_{1t} \ldots\ldots (5)$$

$$MS_t = \sum_{j=1}^{p} \beta_{1j}\, MS_{t-j} + \sum_{j=1}^{p} \beta_{2j}\, GDP_{t-j} + \sum_{j=1}^{p} \beta_{3j}\, INF_{t-j} + \sum_{j=1}^{p} \beta_{4j}\, EX_{t-j} + \varepsilon_{2t} \ldots (6)$$

$$INF_t = \sum_{j=1}^{p} \lambda_{1j}\, INF_{t-j} + \sum_{j=1}^{p} \lambda_{2j}\, MS_{t-j} + \sum_{j=1}^{p} \lambda_{3j}\, EX_{t-j} + \sum_{j=1}^{p} \lambda_{4j}\, GDP_{t-j} + \varepsilon_{3t} \ldots\ldots (7)$$

$$EX_t = \sum_{j=1}^{p} \delta_{1j}\, EX_{t-j} + \sum_{j=1}^{p} \delta_{2j}\, GDP_{t-j} + \sum_{j=1}^{p} \delta_{3j}\, INF_{t-j} + \sum_{j=1}^{p} \delta_{4j}\, MS_{t-j} + \varepsilon_{4t} \ldots\ldots (8)$$

From equations (5) - (8) above, i is the period, n is the number of lags, α_{1j}, β_{1j}, λ_{1j} and δ_{1j}, are coefficients to be estimated and ε_{it} is the error term. The estimation of the equations is done using Eviews by using the data from World Bank (WDI) for the period 1980-2021. This would enable us to make Granger causality test and most especially would enable us relate the effect of shocks of a variable on the others. The time series dataset used in this research is for Nigeria covering the period of 1980-2021 inclusive. All the variables are expected to have a positive sign except inflation and exchange rate.

4.0 Estimation of Results

4.1 Summary statistics and Correlation

This subsection reports the summary statistics and correlation coefficients. Table 4.1 displays both the Summary Statistic (in Panel A) and Correlation (in Panel B). First, the descriptive statistics are reported in panel A of Table 4.1 for economic growth (GDP), exchange rate (EX), inflation (INF) and money supply (MS) in Nigeria for the period of 1980-2021. The summary statistics revealed that the data set in the panel is balanced. The total is expected to be 42 data points. This descriptive or summary statistics are reported in table 4.1

Table 4.1 Summary Statistics and Correlation

Panel A: Summary Statistics

Variable	GDP_t	EX_t	INF_t	MS_t
Obs	42	42	42	42
Mean	3.06917	150.399	18.7353	16.8598
Std. Dev.	5.32239	116.504	16.5131	6.16483
Min	-13.128	49.7447	5.38801	9.06333
Max	15.3292	536.89	72.8355	28.6252

Panel B: Correlation

Variables	GDP_t	EX_t	INF_t	MS_t
GDP_t	1	-0.4655	-0.2094	0.11659
EX_t	-0.4655	1	-0.1415	-0.2364
INF_t	-0.2094	-0.1415	1	-0.2836
MS_t	0.11659	-0.2364	-0.2836	1

Source: Author's Compilation using E-VIEWS 10

Mean is the average value of the series which is derived by dividing the total value of the series by the number of observations. In the panel it takes into account all the series that make up the panel; thus, it features the average of the average panel. From table 4.1 the mean for economic growth (GDP), exchange rate (EX), inflation (INF), and money supply (MS) are 3.069167, 150.3994, 18.73531, and 16.85975 respectively.

Maximum and minimum is the highest and lowest values of the series for the period under study. The table above indicates that the maximum values for economic growth (GDP), exchange rate (EX), inflation (INF) and money supply (MS) are 15.3292, 536.89, 72.8355 and 28.6252 respectively while the minimum values of economic growth (GDP), exchange rate (EX), inflation (INF) and money supply (MS) are -13.128, 49.7447, 5.38801 and 9.06333 respectively.

Standard Deviation is a measure of spread or dispersion in the series. From the table 4.1, the standard deviation for economic growth (GDP), exchange rate (EX), inflation and money supply (MS) are 5.32239, 116.504, 16.5131 and 6.16483 respectively. This shows that exchange rate had a large spread over the period under study while the economic growth has comparatively a minimal spread.

Panel B of Table 4.1 displays the correlation coefficient for the variables used. The estimated correlation coefficient reports that none of the variables is highly correlated with each other; hence, the model is expected to have no multicollinearity issues when estimated. In other words, researchers have reasoned that when variables are correlated and estimated in the same regression there is likely to be multicollinearity issues and as such, to rescue such a situation, it is advisable to independently estimate correlated variables (Azu and Muhammad, 2020). The situation from estimated correlation does not warrant such a scenario rather all the variables can be estimated at once.

4.2 Stationarity Test and VAR Lag Order Selection Criteria

The unit root results presented in table 4.2 are the Augmented Dickey Fuller (ADF) test for unit root test. The ADF unit root test is chosen for the series because it is often used and is known to produce reliable results. The stationarity test findings demonstrate that all variables are stationary at either first difference or at level, with no variables stationary at the second difference, making the proposed methodology appropriate for this study. Given that the test statistic for each of the variables listed in table 4.2 is higher than the critical value, inflation is stationary at the level and first difference and statistically significant at 1% and 5%.

GDP is not stationary at level for both constant and trend. However, it is stationary at first diffence for both constant and trend. The results show that it is statistically significant at 1%.

Exchange rate on the other hand is not stationary at level but it is stationary at first difference for both constant and trend and statistically significant at 1%.

In the same vein, money supply is not stationary at level. However, it is stationary at first difference for constant and trend at 1% level of significance.

The order of integration for all the variables considered is one i.e. I(1). Hence, the need to adopt the VAR

methodology.

Table 4.2 Unit Root Test (ADF)

	Level		1st Difference		Remark
Variable	**Constant**	**Trend**	**Constant**	**Trend**	
GDP_t	-2.7955	-2.4612	-11.8671***	-11.9540***	I(1)
EX_t	-1.9634	-2.0275	-4.4248***	-4.4011***	I(1)
INF_t	-3.0940**	-3.8107**	-5.9857***	-5.9006***	I(1)
MS_t	-2.2348	-2.3471	-9.3798***	-8.9966***	I(1)

Note: Numbers in the display are t-statistics generated with lag 1. *** p<0.01, ** p<0.05, * p<0.1; Null hypothesis (H_0): the variable has a unit root. Constant-constant only & Trend-constant and Trend

To determine the optimum lag length, we begin with a lag of twenty but finally selected an optimum lag of two. We employed the sequential modified LR test, the final prediction error (FPE) test, Akaike information criterion (AIC) test, Schwarz information criterion (SIC) test and Hannan Quinn (HQ) information criterion at 5 percent level of significance to carry out the selection. All the test results in Table 4.3 indicate a lag order of two.

Table 4.3: VAR Lag Order Selection Criteria

Endogenous variables: GDP EX INF MS
Exogenous variables: C
Date: 12/21/22 Time: 11:23
Sample: 1980 2021
Included observations: 40

Lag	LogL	LR	FPE	AIC	SC	HQ
0	-649.8335	NA	1.85e+09	32.69168	32.86057	32.75274
1	-561.2748	154.9778	49500303	29.06374	29.90818*	29.36906
2	-538.8992	34.68222*	36939151*	28.74496*	30.26495	29.29454*

* indicates lag order selected by the criterion
LR: sequential modified LR test statistic (each test at 5% level)
FPE: Final prediction error
AIC: Akaike information criterion
SC: Schwarz information criterion
HQ: Hannan-Quinn information criterion

4.3 Stability and Diagnostic Tests

There is no way we can overstate the importance of stability tests. To ensure dependability and trustworthiness of the outcomes, it is essential to assess the model's stability. The purpose of these tests is to evaluate the applicability and stability of the model used in this project.

Table 4. 4 Diagnostic Test Results

R-Square	0.8646
Adjusted R-square	0.8298
Normality Test	1.455036
Serial Correlation	(0.4279)
Heteroscedasticity Test	(0.2456)

Note: Numbers in parentheses are probabilities, Normality Test, LM Serial correlation Test and VAR Residual Heteroscedasticity test (levels and squares) were utilised. All were done using E-views

Under the Roots of characteristic Polynomial Test, results shows that no root lies outside the unit circle as shown in figure 1 and hence the VAR satisfies the stability condition. A movement from this zone of stability will suggest an error in the model definition. The normality tests have also revealed why the VAR estimator was chosen in the first place.

In order to determine the degree of dependability of the model used in the project work, various diagnostic tests were also conducted as part of this thesis. The Jarque-Bera test for normality and the LM test for serial correlation have both been incorporated. Additionally, heteroscedasticity tests were run. All of these tests also showed that the model is normal and that serial correlation and heteroscedasticity are not present. The independent factors have a significant impact on the dependent variable, as indicated by the high R-square and Adjusted R-Square. Since their probabilities are quite high, the null hypothesis for the tests of normality, serial correlation, and heteroscedasticity could not be disproved.

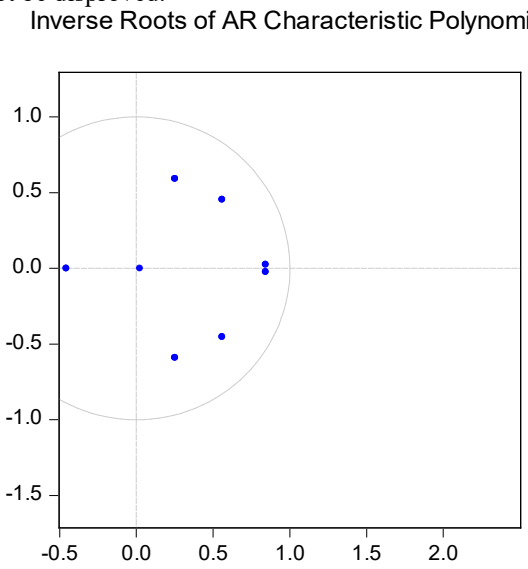


Fig. 4.1 Normality test

4.4 Discussion of Unrestricted VAR Results

The results of the VAR analysis in table at lag two indicate that the variables are dynamically interacted. Starting with the growth (GDP) equation, a 1% increase in the previous year values of exchange rate, GDP, inflation, and money supply lead to a 0.3% increase, 33% increase, 3% increase, and 26% increase in current GDP respectively. Here, GDP and money are positively related. In the same vein, a 1% increase in the previous two years values of exchange rate, GDP, inflation, and money supply lead to a 6.78% increase, 33% increase, 1% decrease, and 29% decrease in current GDP respectively.

The money supply (equation 2) shows that a 1% increase in the previous year values of exchange rate, GDP, inflation and money supply lead to a zero decrease, 8% decrease, 7% decrease and 91% increase in current money supply. The result is consistent with monetary policy given that the relationship between money supply and inflation. A situation known as demand pull inflation or too much money pursuing too few goods and the result is inflation. More so, an increase in the previous two years value of exchange rate, GDP, inflation and money supply lead to 0.5% decrease, 2% increase, 0.1% increase and 7% decrease in the current money supply respectively.

The equation of inflation (equation 3) shows that a 1% increase in the previous year values of exchange rate, GDP, inflation and money supply lead to 9% decrease, 33% decrease, 68% increase and 15% increase in the current level of inflation. Furthermore, an increase in the previous two years value of exchange rate, GDP, inflation and money supply lead to 2% increase, 95% decrease, 29% decrease and 70% decrease in the current level of inflation respectively.

Followed by the equation of exchange rate (equation 4) a unit increase in the previous year values of exchange rate, GDP, inflation and money supply lead to 0.93 unit increase, 5.64 unit decrease, 0.73 unit decrease and 2.25 unit decrease in the current level of exchange rate. In the same manner, a unit increase in the previous two years value of exchange rate, GDP, inflation and money supply lead to 0.47 unit decrease, 4.50 unit decrease, 0.20 unit decrease and 0.61 unit increase in the current level of exchange rate.

Table 4.5: Vector Autoregression Estimates
Date: 03/02/23 Time: 12:16
Sample (adjusted): 1982 2021
Included observations: 40 after adjustments
Standard errors in ( ) & t-statistics in [ ]

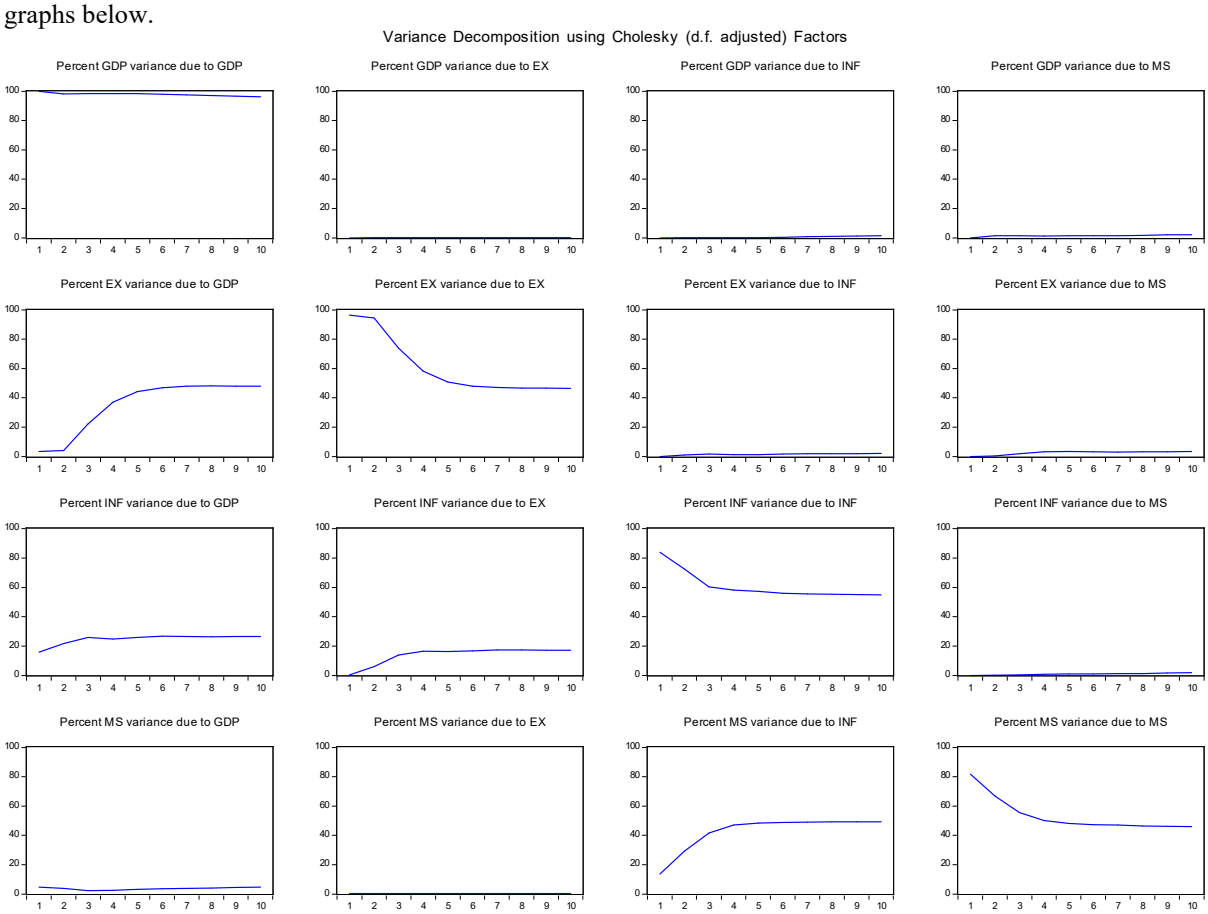
	EX	GDP	INF	MS
EX(-1)	0.937023	0.003415	-0.090844	-0.000167
	(0.14134)	(0.01212)	(0.03646)	(0.00653)
	[6.62937]	[0.28181]	[-2.49129]	[-0.02552]
EX(-2)	-0.475302	6.78E-05	0.029585	-0.005838
	(0.13777)	(0.01181)	(0.03554)	(0.00636)
	[-3.44999]	[0.00574]	[0.83239]	[-0.91770]
GDP(-1)	-5.644132	0.334761	-0.330626	-0.085716
	(1.87080)	(0.16039)	(0.48264)	(0.08639)
	[-3.01696]	[2.08723]	[-0.68504]	[-0.99225]
GDP(-2)	-4.507607	0.337245	-0.950707	0.022353
	(2.03541)	(0.17450)	(0.52511)	(0.09399)
	[-2.21459]	[1.93266]	[-1.81050]	[0.23784]
INF(-1)	-0.738312	0.038484	0.685775	-0.074827
	(0.65650)	(0.05628)	(0.16937)	(0.03031)
	[-1.12462]	[0.68376]	[4.04905]	[-2.46839]
INF(-2)	0.200794	-0.015004	-0.299958	0.001656
	(0.62177)	(0.05330)	(0.16041)	(0.02871)
	[0.32294]	[-0.28147]	[-1.86998]	[0.05767]
MS(-1)	-2.250820	0.260489	0.159132	0.912306
	(2.68876)	(0.23051)	(0.69366)	(0.12416)
	[-0.83712]	[1.13006]	[0.22941]	[7.34812]
MS(-2)	0.619633	-0.296382	-0.703478	-0.075844
	(2.40027)	(0.20578)	(0.61923)	(0.11083)
	[0.25815]	[-1.44031]	[-1.13605]	[-0.68431]
C	144.6700	1.011129	33.47503	5.522587
	(49.2543)	(4.22261)	(12.7069)	(2.27434)
	[2.93721]	[0.23946]	[2.63440]	[2.42821]
R-squared	0.864692	0.435881	0.589343	0.894499
Adj. R-squared	0.829774	0.290302	0.483367	0.867274
Sum sq. resids	68474.05	503.2700	4557.390	145.9992
S.E. equation	46.99830	4.029208	12.12487	2.170173
F-statistic	24.76332	2.994118	5.561094	32.85467
Log likelihood	-205.6642	-107.4025	-151.4701	-82.65197
Akaike AIC	10.73321	5.820124	8.023503	4.582599
Schwarz SC	11.11321	6.200122	8.403501	4.962597
Mean dependent	142.6910	3.445702	18.90245	16.71363
S.D. dependent	113.9118	4.782807	16.86887	5.956835

Determinant resid covariance (dof adj.)	16403728
Determinant resid covariance	5917651.
Log likelihood	-538.8992
Akaike information criterion	28.74496
Schwarz criterion	30.26495
Number of coefficients	36

The overall goodness of fit shows that 86.4% variation in exchange rate is caused by the variations in the previous values of inflation inertia, GDP, money supply and exchange rate. While 43.6% variation in GDP is caused by the joint variation in the previous values of inflation inertia, exchange rate, GDP, and money supply. The equation of inflation indicates that 58.9% variation in inflation is caused by the joint variation in the previous values of inflation inertia, exchange rate, GDP and money supply. While 89.4% variation in money supply is caused by the joint variation in the previous values of inflation inertia, exchange rate, GDP and money supply.

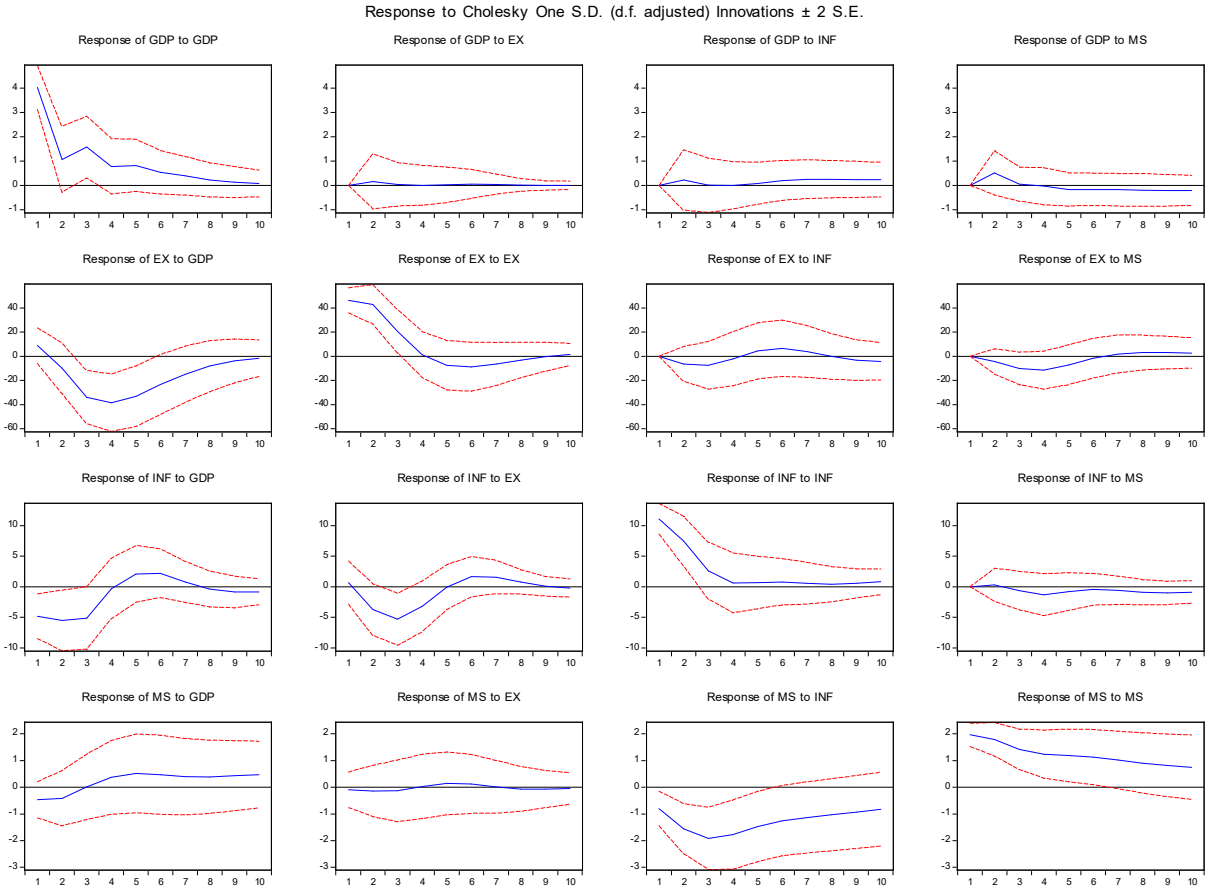
Variance Decomposition

This section has to do with assessing the relative contribution of the variables to the fluctuation in inflation, GDP, money supply and exchange rate. This is done by decomposing the forecast variance as shown in the multiple graphs below.



Impulse Response

The graphs indicate the impact of shock on macro-economic variables. The impulse response function traces the effect of each shock on each variable in VAR under the period of study.



5.0 Conclusion and Recommendations

With regards and emphasis on the above data analysis and summary, this manuscript concludes that the nature of inflation in the country was cost-push attributed to the method of technology adopted and the level of high exchange rate in the country. This will make it possible for inflation rates if regressed along to behave abnormally to growth rates of output in Nigeria. A historical analysis of monetary policy in Nigeria within this framework suggests that monetary conditions might have been less accommodative and, hence, inflation and high exchange rate in Nigeria might have been lower and less volatile than what was observed in recent past had Nigeria followed prescriptions based on a rule consistent with price stability. In conclusion therefore, fight against high exchange rate and inflation in Nigeria is not going to be easy or a short run affair, this is because what brought about high exchange rate also brought about reduction in the growth rates of output in the country and what brought about high inflation rates also brought about improvement in the growth rates of output in Nigeria. This study concludes by saying that combating the challenges of the rising inflation and high exchange rate in Iraq is not a small task for policy makers. The consequences of a growing inflation and high exchange rate phenomenon are so damning that Nigeria cannot afford them. Such implications are glaring in the economy of Nigeria where many negative developments were traceable to the non-availability of jobs for the teaming population of energetic youths with a frequent rise in general price level coupled with frequent violence, banditry, kidnapping and terrorism. Therefore, the need to aptly address this ugly development becomes paramount.

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