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The impact of Central Bank's Credits to the Federal Government on the Effectiveness of Open Market Operations in Nigeria

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Abstract: This paper investigates the impact of the Central Bank's credit to the Federal Government on the effectiveness of open market operations (OMOs) as a tool of monetary policy in Nigeria from 1993Q1-2021Q4. The monetary instability in Nigeria is a result of the ineffective use of market-based monetary policy instruments which have worsened liquidity conditions and sparked inflationary pressures in the economy. The study used the ARCH/GARCH method in order to analyse the quarterly secondary data collected from the Central Bank of Nigeria and the National Bureau of Statistics. The findings of the study showed fiscal deficits rise or fall as the Central Bank's credit to the Government rises or falls. Also, CBN credits to the Federal Government had a significant negative impact on the effectiveness of OMO sales in Nigeria. The ARCH and GARCH terms in OMOs implied that volatility is persistent in the open market for treasury bills in Nigeria. Furthermore, the OMO sales forecasts showed that the conditional variance of the model converges to a steady quickly stated thereby implying that OMOs are effective. The study concludes that OMOs if more efficiently utilised, could stabilise monetary aggregates and stabilise prices in the economy.

Keywords: Central Bank's Credit, Federal Government, Fiscal Deficits, Open Market Operations.

Introduction

The Open Market Operation (OMO) is the fundamental instrument for the conduct of monetary policy in developed countries as well as in other developing countries such as Nigeria. This is because of its flexibility and usefulness in influencing the level of bank reserves to achieve the desired level of macroeconomic objectives, (especially as it relates to liquidity situations in the economy). Since the maintenance of sound financial system stability is central to the objective of the Central Bank of Nigeria (CBN), the adoption of active OMO in 1993 has helped the control inflation and the restored stability in the Nigerian economy, (CBN, 1995). Developments over the years in the conduct of monetary policy suggest that the CBN has consistently maintained OMO as the primary tool or instrument of monetary policy control in Nigeria. Other instruments of monetary stability included the monetary policy rate (MPR), cash reserve ratio (CRR), Liquidity ratio, discount window operations and foreign exchange market interventions. According to the International Monetary Fund (n.d.), Central banks conduct monetary policy by adjusting the supply of money via the purchase or sale of government securities in the open market. When central banks lower interest rates, the monetary policy is easing and when it raises interest rates, monetary policy is tightening. This paper observed that the use of OMO instruments has been ineffective over the years due to the limited number of instruments traded in the open market (Leo, 2012). Although the open market has improved over, the years, the depth of instruments being traded appears to be few or predominantly treasury bills. Besides that, there are a limited number of investors who are unable to absorb the volume of liquidity in circulation by their investments in the OMO market. The large volume of liquidity in circulation triggered inflation in the past years, thereby making OMO instruments weak or ineffective for price stability (Leo, 2012). The open market also recently appeared unattractive to investors or the general public due to low yields on instruments which could not allow mass public interest or investment in the open market by participants. These low yields and investments were largely due to a lack of public awareness or lack of access to the open market by the general public. Although Bulusu (2020) observed that the process of creating awareness or public announcement of OMO is expensive, they are necessary for the growth of the financial market. This created a condition of monetary instability that could only be improved upon through effective OMOs. The CBN had attempted implementing measures such as quantitative easing (a policy aimed at increasing the holding of traditional securities) and credit easing (a policy aimed at the diversification of the CBN portfolio to private securities) but the measure was still ineffective and could not control price instability in the economy (Kure et al., 2019). Turker (2022) reported that quantitative easing creates money that goes into deposit money bank reserves at the Central Bank which are being fully remunerated at the Central Bank's policy rates. Therefore, this paper argues that monetary instability in Nigeria is a result of the ineffective use of market-based OMO instruments which has worsened liquidity conditions and sparked inflationary pressures in the economy (Leo, 2012).

OMOs have real effects especially when credit instruments possess liquidity premiums in the economy (Carli & Gomis-Porqueras, 2020). However, the fiscal dominance and the growth of CBN's credits to the Federal Government can also exert pressure on the domestic economy thereby threatening effective OMO and liquidity management. According to the CBN (2006), the growth of credits to the Federal Government (which is one of the major sources of growth in the broad money supply) and the monetisation of oil revenue has continued to pose serious challenges to the CBN in stabilizing the economy. Government fiscal dominance and fiscal operations especially the financing of large budget deficits from the banking system can continuously undermine the objective of liquidity management and hence threaten macroeconomic stability in the economy. Ogun and Adenikinju (1995), maintained that in a high-inflation environment, the effects of inflation or price increases on public debt are very crucial in monetary policy management. This is because price increases not only decrease tax revenues but also increase Government spending. Over the years, the Government spending, fiscal deficits and public debt have been growing probably because of the need to provide social infrastructures, generate employment opportunities and the expanding size of the Government. In 2007,

CBN data shows that the Government spending increased by 20.3% to 2450.9 billion Naira compared to 2006 value (CBN, 2021). By 2018 and 2021, the Government spending had increased to ₦7,813.7 billion and ₦12,164.1 billion respectively. Overall fiscal operation of the Federal Government resulted in a national deficit of ₦117.2 billion compared with the deficit of ₦100.8 billion recorded in 2006. The deficit rose to ₦810.1 billion in 2009. By 2021, the deficits had risen to ₦7,118.7 billion. Most of the deficits were financed entirely from domestic sources. The domestic debt of the Government witnessed a significant growth in 2009, 2017 and 2021 with the value of transactions increasing almost fourfold. According to the CBN, (2009), the value of the Federal Government of Nigeria bonds increased by 36.61%, representing 61.18% of total domestic debt outstanding in 2009. By 2021, the government budget deficit and domestic public debt instruments had risen to over ₦7.12 trillion and ₦19.24 trillion respectively (CBN 2021).

Apart from the Government spending and fiscal effects on the general price level, the CBN also releases a substantial amount of liquidity through the money supply channels into the economy (such as real sector intervention programmes) to enhance stabilisation policies and corporate governance (Kure et al., 2019). All these fiscal and monetary policies interplay by the government can undermine the objective of macroeconomic stability in the country. According to Bogunjoko (1997), the impact of Government fiscal deficits on the monetary base depends on the mode of financing the deficits. Bank reserves remain unchanged when the Government finances its fiscal deficits from the non-bank public while monetary disequilibrium emerges when a fiscal deficit is financed through the banking system. Schreft and Smith (1994) put it that spatial separation and limited communication in the capital accumulation process, create a role for money and random shock to agents' portfolio needs creates a role for banks. The paper is important to policymakers who are faced with various policy targets in an open market with a limited number of tradable instruments. The paper is structured into five sections. Immediately after the general introduction in section one, the relevant literature, theories and empirical studies were reviewed in section two. The research methodology and theoretical framework were provided in section three of the paper while the analysis and discussion of results were presented in section four. Finally, section five contained the conclusion and policy recommendations for the paper.

Research Problem

A careful observation of monetary policy management in Nigeria revealed a situation of persistent overshooting or undershooting of monetary policy targets. In other words, there exists a wide divergence between monetary policy targets and the actual performance of monetary policy instruments. Provisional data on actual and target levels of monetary aggregates also indicated large deviations from the targets. In 1994, the actual level of base money exceeded the target by 13.5%, (Ojo, 1999). As a result, the inflation rate rose to 57.0% the same year. The gap in base money further rose to 27.1% in 1995 with an inflation rate of 72.9%. Recently in 2020, the actual narrow money supply exceeded its target rate by 40.345% (CBN, 2021). Similarly, the divergence in broad money supply has been persistent over the years. The actual broad money supply exceeded its target by 4.83% and 2.99% in 2020 and 2021 respectively. The major sources of growth in the monetary aggregates were CBN credits to the Federal Government (Ojo, 1999; CBN, 2006). Demiralp and Jorda (2001) asserted that the deviations of the actual policy instruments from the target level during the previous day are an indicator of banking sector reserve imbalances. The CBN had attempted implementing measures such as quantitative easing (a policy aimed at increasing the holding of traditional securities) and credit easing (a policy aimed at the diversification of the CBN portfolio to private securities) but the measure was still ineffective and could not control the price instability in the economy (Kure et al., 2019). Money supply exceeded the absorptive capacity of the Nigerian Economy. Since the volume of excess liquidity in circulation was above the absorptive capacity of the economy, it created a condition of monetary instability that could only be improved upon through effective OMOs.

Research Focus

OMOs play a crucial role in steering interest rates, managing the liquidity situation and signalling monetary policy stance in the financial market (European Central Bank, 2023). The paper focuses on the effectiveness of monetary policy in an environment of fiscal dominance. Specifically, the impact of CBN credit to the federal government on the effectiveness of OMOs in Nigeria was analysed.

Research Aim and Research Questions

Therefore, the main objective of this paper was to examine the impact of CBN's credit to the Federal Government on the effectiveness of OMO in Nigeria for the period 1993Q1–2021Q4. It also highlighted the impact of fiscal deficit on CBN credits to the Federal Government in Nigeria. Thus, the questions to the topic were the next; 1) Does CBN's credits to the federal government the budget deficits? 2) What is the impact of CBN credits on the effectiveness of OMOs in Nigeria?

Literature Review

Concept of Open Market Operations and CBN Credits

An open market is a market with no regulatory barriers and prices of instruments traded are determined by forces of demand and supply (Corporate Finance Institute, n.d.). Open market operation refers to the process in which the Central Bank implement monetary policy by controlling short-term interest rate and money supply in the economy. According to Ojo (1999), OMO involves achieving the target rate of base money through the buying and selling of Government securities or other financial instruments in the open market. Hopper (2019) defined OMO as Central Bank purchases and sales of government securities to expand or contract money in the banking system and influence interest rates. Hayes (2022) defined OMO as the purchase and sale of treasury securities in the open market by the Central Bank to regulate the supply of money. One of such securities is Treasury Bills (TBs). Other instruments are CBN bills, treasury certificates, banker's acceptance, etc. The European Central Bank (n.d.a) sees OMO as the supply of liquidity that is consistent with the desired level of short-term interest rates in the open market. According to the Federal Reserve Bank of New York (2008), when there is an increased or decreased demand for base money, action is taken to maintain short-term interest rates (i.e. to increase or decrease money supply). The Central Bank goes to the open market to buy or sell financial assets such as TBs, Government bonds, Gold or foreign exchange. To pay for or receive from these transactions, bank reserves in the form of new base money (e.g. newly printed cash) are transferred to the seller's or buyer's bank and the seller's or buyer's account is credited, hence the total volume of base money in the economy is increased or decreased. Bustamante (2021) maintained that there is little understanding of how OMOs affect households with varieties of portfolios and levels of wealth. Different individuals save wealth using both money and government bonds while facing random liquidity needs. An OMO that increases the supply of government securities tends to raise interest rates and economic activity in the country. Banda (2020) reported that OMO performs mainly two roles. First as a fiscal tool by facilitating government borrowing from the general public and second as a tool of monetary policy.

However, the credit is defined as the status of being trusted to pay money back to somebody who lends it to someone. According to Merriam-Webster (n.d.), credits are the provision of money, goods or services with the expectation of future payment. CBN credit refers to a sum of money lent out by the Central Bank to the Federal Government which agrees to pay back with interest at a future date (Leo, 2012). Both the CBN and the Government need a reliable marketplace for Government securities, where participants feel secure that transactions will be performed according to their obligations and which is transparent enough to encourage wide participation, (Axilrod, 1997). According to Ojo (1999), the existence of a free market economy, functional legal and regulatory authorities, a well-developed financial market, an effective information and communication base, a sound monetary programme and the sustenance of confidence in the financial sector are very crucial for the smooth operation of indirect

monetary policy instruments in Nigeria. Monetary targets such as money supply, inflation, interest rates or exchange rates are used to direct the process of indirect monetary policy instruments (Hummel, n.d.; Johnson, n.d.). The different monetary policy frameworks in which OMOs could operate include gold standard targeting, fixed exchange rate targeting, price level targeting, monetary targeting, inflation targeting and mixed policy targeting. Liquidity management, however, means the process of controlling the supply or demand of the volume of liquidity that is suitable with a predicted level of short-term interest rates or monetary base in the open market (CBN, 2010a). Liquidity management relies on the assessment of the liquidity situations in the banking sector, to estimate its liquidity needs and thus the amount of liquidity to allocate to or withdraw from the markets. The objective of liquidity management is to avert unexpected market developments that may affect the objectives of price stability in the economy (CBN, 2010b). In the United States, the Federal Reserve Bank implement monetary policy by using the short-term interest rate to maintain and control the excess reserves of the banking system (Federal Reserve Bank of New York, 2023). The CBN usually make use of OMO complemented by macro-prudential cash and liquidity ratios, reserve requirement, standing facilities, tenured repurchased transactions, sale of treasury instruments and foreign exchange market intervention for liquidity management (CBN, 2010c).

Fiscal Dominance, Fiscal Deficits and Monetary Policy Management. Oyejide (2003), posit that the monetarist theory of monetary policy assumes that the Central Bank uses monetary policy instruments predominantly to influence economic activities in the economy. But in an environment of increasing Government expenditure and uncontrolled budget deficits, the monetary policy may not be an effective tool of stabilization. It can only accommodate fiscal policy (Oyejide, 2003). According to Sargent and Wallace (1981), the growing size of fiscal budget deficits may rapidly translate into inflation if economic agents expect that monetary policy independence will not be maintained under increasing public debt or borrowing. That is to say that the expectations of future growth of the money supply can be so large that it may result in inflation, thus undermining the effort of the Central Bank to achieve monetary stability. Mas (1994) and Oyejide (2003), argued that in countries with low-income and shallow financial systems, monetary policy can only play an accommodative role in fiscal policy. This is because, in such countries, Government securities markets are underdeveloped; Central Banks do not hold enough tradable securities and the Central Bank's a limited choice of instruments of monetary policy control. They further argued that these factors constitute what induces fiscal dominance in such countries.

According to Idowu (2010), fiscal policy in Nigeria has over the years hampered the monetary policy management largely due to its expansionary nature thereby forcing the CBN to continually adjust its monetary programme to counter the effects of fiscal dominance. Beginning in 2001, the Federal Government of Nigeria undertook several fiscal reforms including oil price benchmarking, due process, ministerial restructuring, etc. which brought some level of fiscal restraint. The reform measures suffered setbacks as fiscal developments shortly afterwards became inimical to monetary processes (Idowu, 2010). Anyanwu (1997), puts it that the task of effective monetary management in Nigeria is an issue of fiscal policy dominance and the need to properly coordinate fiscal and monetary policies for effective performance. The financial programming and the liquidity management frameworks in Nigeria have tried to harmonize the conflict in fiscal and monetary policies.

Government Credit Instruments in Nigeria. There are many sources of government credit but this paper is limiting it to domestic debt instruments. The Federal Government of Nigeria mobilises funds for its developmental projects by issuing debt instruments. The OMO instruments can help maintain price stability and support economic growth (Jones, n.d.). It is useful for monetary policy during economic recessions and the COVID-19 period to adjust the supply of reserves via the interest rate (Federal Reserve Board of Governors, n.d.). The Federal Government established the virile bond market in 2003 to finance its fiscal budget deficits domestically and externally in a non-inflationary

manner and keep all debt obligations at sustainable levels compatible with the desired economic activities for growth and development (Debt management office (establishment) act, 2003; Debt Management Office, 2003). Since then, the bond market has become a major source of Government credits in the domestic economy. The Federal Government has issued over ₦17.0 trillion worth of bonds in the market (CBN 2021). The value of money market domestic debt instruments of the Federal Government is shown in Appendix 1, Figure 1. In Figure 1 of Appendix 1, the Federal Government restructured the 91-day Nigerian Treasury bill into longer-term bills in 1997. For instance, in 1997, the un-traded treasury bonds in the bank's portfolio were restructured into an intervention security and subsequent treasury bonds were converted to Treasury Bills (worth N103.0 billion) to mop up excess liquidity in the economy (Ojo, 1999). These TBs and securities had been major instruments in secularising outstanding ways and mean credits of the CBN. In 2006, Federal Government bonds represented 36.73% from 0.14% in 2002, of domestic debt instruments outstanding in the money market (CBN, 2006). This was due to increased emphasis on Federal Government bonds as a means of funding Government fiscal budget deficits. The market further witnessed significant growth in 2009 with the value of transactions increasing almost fourfold more than the value in 2006. The value of bonds increased by 36.61%, representing 61.18% of total domestic debt outstanding in 2009 (CBN, 2009). However, in 2010, the Federal Government bond value increased by 46.92%, representing 63.73% of the total domestic debt outstanding. The issuance of treasury bills in 2010 also increased to ₦1277.1 billion (CBN, 2010b). By 2013, the issuance of treasury bills had reached ₦2,581.6 billion while FGN bond stood at ₦4,222.0 billion in the year.

By 2021, the value of treasury bills outstanding was ₦3,786.14 billion while the value of FGN bonds stood at ₦17,866.50 billion. The growth of these money market instruments suggests that they could be effective instruments of liquidity management if they are properly incorporated into the OMO of the Central Bank in Nigeria. The recent cashless policy of the CBN has appeared to be effective in restricting the quantity of cash that people hold, but ineffective in controlling inflation and exchange rate fluctuations. A plausible explanation is that there was a large quantity of liquidity in circulation with few instruments to mop up the liquidity. Still, the introduction of the new bank's notes in early 2023, has increased inflationary pressure thereby undermining the CBN's objective of price stabilization. Market-based instruments are usually effective in controlling prices in most advanced countries where less cash is being used because they have varieties of domestic debt instruments that complement their cashless policies. In Nigeria however, the majority of the public is not aware of the opportunities existing in the money market, coupled with a limited number of investors. Figure 1 of Appendix 1 also showed that the bulk of domestic debt instruments has shifted from traditional debt instruments such as treasury certificates and development stocks to treasury bonds, FGN Sukuk, FGN green bonds, FGN saving bonds and Federal Government of Nigeria bonds (FGNB). Therefore, issuance of debt instruments by the Federal Government usually reduces the amount of liquidity in the economy and thereby keeps the inflation rate under control. The Government spending in some cases (such as electioneering campaigns) tends to be inflationary. This may be due to the spending of the borrowing proceeds on unproductive investments in the past which could have an increased inflationary pressure on the economy.

Fiscal dominance and operations of the Federal Government may render liquidity management ineffective because it may not reflect intergovernmental relationships. It may not recognise some crucial channels through which fiscal dominance and operations can affect monetary policy (Garba, 2004). Therefore, OMO can be negatively affected in economies where there is uncontrolled fiscal budget deficits and weak intergovernmental relation. So, an increase in Government spending and fiscal dominance usually exerts pressure on the domestic economy and thus threatens the stability of prices and output growth. The CBN usually respond to this pressure by selling or buying the Federal Government securities through the process of OMO. The OMO of the CBN enables her to reduce the effects of excess bank reserves in the economy. The problem is that a large portion of the issued

securities are left unsubscribed thus creating a leakage in the liquidity stream in the economy. This problem has made the attainment of monetary targets difficult thus resulting in persistent target overshooting or undershooting in the conduct of monetary policy.

Theoretical Literature

The quantity theory of money postulated by Irving Fisher held that a proportional direct relationship exists between changes in money supply (credits to the government) and the general price level and is inversely related to the value of money (what money can buy in real terms). That is to say that the circulation of money stock in the economy is related to the amount of money expended in the economy during a given period. Irving Fisher argued that people demand money for transactional purposes only and the demand for money can be expressed as an identity between the amount of money supply and its velocity to the quantity of output produced with the price level of that output. Such a relationship between credits (money supply) and prices is inflationary and does not fit a modern economy where price variations are not occurring in the same proportions.

The Neo-classical or Cambridge school theory of money tried to critique the quantity theory by capturing the store of value function of money. Alfred Marshal, A.C. Pique, and John Maynard. Keynes was the proponent of Cambridge's theory. They argued that the quantity of money demanded in the economy varies in direct proportion to the volume of the final transaction or level of income. They further argued that if the supply of money is held fixed in the economy, the value of money is influenced by the demand for cash balances. John Maynard Keynes in his general theory of employment, interest and money, again criticized the neoclassical economists for explaining the distinct monetary theory and value theory (Keynes, 1936). Keynes presented a different quantity theory of money which changed the monetary theory of prices (microeconomics) to a monetary theory of output (macroeconomics), (Jhingan, 2002). Both Keynes and the structuralist upheld the classical view that the role of money is inflationary under a full employment scenario (Bogunjoko, 1997). According to Keynes, a rise in the money supply may lead to an unacceptable rise in the price level. That is, an action by the monetary authority to lower inflation through contractionary monetary policy may cause unemployment in the economy. He further argued that when money supply rises, it first impacts the rate of interest negatively and given the marginal efficiency of capital, a fall in interest rates will lead to a rise in the volume of investment. The increase in investment will also boost aggregate demand through the multiplier effect thereby causing income, output and employment to increase (Mishkin, 1995).

The monetarist economists led by Milton Friedman reaffirmed the position of the neo-classical economists (Friedman, 2016). Friedman challenged the Keynesian view that the money supply does not matter. According to Friedman, inflation is always and everywhere a monetary phenomenon. Inflation arises from expansionary monetary policies that increase money supply more than total output. The changes in the money supply will work through to cause changes in income. When the money supply rises, it will increase the demand for goods and services and then lead to increases in price level or nominal income or both. As a result of the dissatisfaction with the various monetary theories, John Hicks in 1937 and Alvin Hansen in 1953 employed Keynesian tools in a theory (i.e. the **IS-LM** framework) that shows that investment (I), savings (S), liquidity preference (L) and money supply (M) are all related to each other at a particular level of income and interest rate in the economy, (Jhingan, 2002). However, the **IS-LM** framework was criticized for its unrealistic assumptions. From the above discussion, it is obvious that no monetary theory is adequate to explain the peculiarities of modern-day economies. Therefore, most economists have come to accept Keynesian economics not as a substitute, but as a necessary complement to neo-classical economic thinking. Although not all economists have accepted Keynesian economics, it seems that Keynesian economics is destined to play a leading role in guiding public policy (Bowden, 1986). This could explain why fiscal policy tends to dominate monetary policy in most economies of the world. However, the focus of this study is not on the debate.

Liquidity Management Framework and OMO in Nigeria. The objective of liquidity management is to avoid unhealthy market development that could affect the objectives of price stability in the economy. Kure et al. (2021) describe the liquidity as the ability to meet the demand for liability items or loan requests. By influencing short-term interest rates, OMO affects the borrowing costs of economic agents and hence spending and investment decisions (European Central Bank, n.d.b). Monetary policy authorities influence economic growth through several transmission channels. According to the CBN (2009), the role of monetary policy in sustainable growth is the maintenance of price stability. This is done by controlling the level of money supply in the economy. Although Ojo (1999) noted that the framework of a market-based monetary policy control technique is generally (but not solely) based on the relationship between money supply and the based money (i.e. monetary base or high-powered money), Kure et al. (2021) had used the rational expectation hypothesis of the term structure (REHT) to link the relationship between liquidity management and the aggregate macro economy. This paper followed the money supply model approach. Therefore, high-powered money (H) refers to the sum of the deposit money bank total reserves (TR) and currency (C) held by the public. i.e.

$$H = TR + C \tag{1}$$

The total reserve of banks is made up of banks' reserve with the Central Bank (CR) plus excess reserve(ER) at the bank.

$$TR = CR + ER \tag{2}$$

But it is known that money supply (MS) consist of currency (C) held by the public plus the deposits (D) of Deposit Money Banks i.e.

$$MS = C + D \tag{3}$$

If dividing equation (3) by equation (1), so that

$$\frac{MS}{H} = \frac{C+D}{C+TR} \tag{4}$$

Also, if dividing the numerator and denumerator of both sides of the equation (4) by D we will have the expression below.

$$\frac{\frac{MS}{D}}{\frac{H}{D}} = \frac{\frac{C}{D}+\frac{D}{D}}{\frac{C}{D}+\frac{TR}{D}} \tag{5}$$

Let: $\frac{C}{D} = Cr$, and $\frac{TR}{D} = TRr$, So that;

$$\frac{MS}{H} = \frac{Cr+1}{Cr+TRr} \quad (6)$$

Where: Cr =currency ratio (cash ratio) of the non-bank public (C/D), TRr = Total reserve ratio of the Deposit Money Banks (TR/D), MS = Money supply, H = Monetary base or high-powered money. Therefore, from equation (6), if we define high-powered money in terms of money supply, it will be:

$$H = \frac{(Cr + TRr)MS}{Cr + 1} \ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots (7)$$

Similarly;

$$MS = \frac{(Cr + 1)H}{Cr + TRr} \ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots (8)$$

$$MS = mH \ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots (9)$$

Where; m = the money multiplier, ($\frac{CR+1}{Cr+TRr}$). So, equation (7) expresses the money base in terms of three determinants, MS, Cr, and TRr. The equation means that when the CBN reduce the currency ratio (Cr) and total reserve ratio (TRr), the money supply in the economy will increase and vice versa (Jhingan, 2002). In equation (9), the money supply is determined by the money base and the money multiplier (m). The size of m is determined by the Cr and TRr of Deposit Money Banks. If Cr, TRr and m are fixed, the Central Bank can easily control the money supply in the economy by influencing the money base (H). The monetary base comprises the assets/liabilities of the Central Bank. i.e.

$$H = NCG + CB + CP + NFA + NOA \ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots (10)$$

Where: NCG = Net domestic claims on the Government; CB = Claims on Banks; CP = Claims on the private sector; NFA = Net Foreign assets; NOA = other assets (Net). If we change H and the relationships continue to hold, i.e.

$$\Delta H = \Delta NCG + \Delta CB + \Delta CP + \Delta NFA + \Delta OAN \ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots (11)$$

Then, the Central Bank needs to monitor the monetary base, H such that ΔH and ΔMS do not go off-course. Therefore various targets could be set to achieve the general objective of monetary policy in the economy. If within a period, base money (H), grows or is expected to grow beyond the target, the Central Bank could reserve the excess by the sale of treasury securities and tighten discount window operations. However, if H falls below target, the authorities would buy back treasury securities, lower the reserve requirements or relax (reduce) discount window operations. Ojo (1999), argued that in practice the Central Bank in its OMO, manages the reserve base of the banks in a manner that facilitates the growth of base money (H). We will specify the relationship between base money (H) and the total reserve base of banks (TR) as follows. The money demand function will equal the money supply function. Therefore, at equilibrium, money demand is equal to the money supply in the economy. That is to say; MD = MS

$$MD = MS = mH \ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots (12)$$

$$MD = mH \ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots (13)$$

$$H = \frac{MD}{m} \ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots (14)$$

But from equation (2), $TR = RR + ER$,

$$C + TR = \frac{MD}{m} \ldots\ldots\ldots\ldots\ldots\ldots\ldots (15); \quad TR^* = \frac{MD}{m} - C \ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots (16)$$

Where: TR* = optimal total demand for reserves by the banking system. The actual supply of bank reserves can be derived from the Central Banks balance sheet on the liabilities side. The monetary base is specified as:

$$H = C + ER + RR \ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots (17)$$

Where: ER = Vault cash of bank, RR = reserve of bank at Central Bank. But from equation (2), $TR = RR + ER$,

$$TR^e = H - C \ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots. (18)$$

Where; TR^e = estimated total banks reserves. Therefore, the combination of equation (16) and equation (18) forms the basis of OMO of the Central Bank. When TR^e exceeds TR*, the Central Bank will sell securities to decrease bank reserves while if TR^e is less than TR*, Monetary Authorities will increase bank reserves by purchasing securities from participants in the open market. According to Ojo (1999), since the introduction of OMO by the CBN, monetary aggregates have been the intermediate targets of policy, which implicitly suggests that the relationship between changes in the growth of the monetary aggregates and economic activity is sufficiently stable and reliable to ensure the achievement of monetary policy objectives. He further argued that the CBN also established target ranges for the growth of broad money (M_2), net domestic credits and net foreign assets given the desired and feasible rates of inflation and growth in real GDP. Now, do wide deviations between monetary policy targets and the actual performance of monetary policy instruments indicate the attainment of monetary policy objectives? If no, then provisional data on actual and target levels of monetary aggregates indicated ineffective monetary policy performance in Nigeria (Ojo, 1999). If we follow the derivations carefully, from equation (1) to equation (18) it is crucial to notice that equations (16) and (18) can be used to derive the value of reserves for OMO. The framework for OMO is as follows:

$$OMO_t = TR_t^* + TR_t^e \ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots. (19)$$

Where OMO_t = the forecast level of OMO on the trading day, TR_t^* = the optimal level of demand for reserves, and TR_t^e = the actual level of reserves on the trading day. Kure et al. (2021) empirically applied the liquidity management framework to examine the effectiveness of liquidity management instruments in Nigeria and reported that monetary policy targets variables asymmetrically respond to changes in monetary policy rates and excess reserves in the economy. Also, discretionary and autonomous liquidity factors symmetrically responded in Nigeria.

Empirical Literature

Empirical evidence abounds on the impact of monetary policy in achieving monetary stabilisation in Nigeria. For instance, Lee (1983) reported that both OMO and foreign exchange rates have identical long-run effects on the economy. He argued that both OMO and foreign exchange rates operations were found to have returned to their original steady state paths of equilibrium where real output or income, money supply, price level and interest rates are proportional and converging in the long run. OMO had steady-state effects on capital stock, real interest rates and real incomes. Dotsey (1986) reported that unperceived OMOs have negative wealth effects on the economy. Ogun and Adenikinju (1995) explored the use of the ordinary least square method in analyzing the money supply mechanism in Nigeria for the period, 1970–1989. The study showed that the monetary expansion of the CBN during the period reduced Nigeria's foreign assets and a money supply level that was above the absorptive capacity of the economy thereby posing the challenge of price instability and real GDP growth. Inoue (1999), examined via ordinary least square the intraday price discovery process in the Government securities market in Japan. He covered the period from 1st July 1996 to 30th June 1998 (i.e. 493 business days). The study found that outright OMO (outright purchases or coupon passes) push fluctuations in trading volume and price volatility, but temporary OMO (repurchase agreements (repos)) or outright purchases by the Ministry of Finance do not affect trading volume and price volatility. He further found that unexpected

changes in the purchase amounts and notification times of OMO increase the spikes. Ezirim and Enefae (2006), investigated using the ordinary least square method, the relationship between discount houses operations and the performance of the money market and the Nigerian economy for the period (1993–2004). The study found that discount house operations affect money market performance both positively and significantly. They further found evidence of a significant relationship between discount house operations and economic growth in Nigeria.

In another study, Omanukwue and Abeng (2008) investigated the effectiveness of the OMO in Nigeria using the error correction mechanism method for the period, 1993Q1–2007Q4. The paper found inflationary expectations, Treasury bill rate, income and fiscal deficits to be influencing the volume of deposit money bank reserves significantly. The study further found that the economy is stabilised or adjusts itself to equilibrium within three quarters in the event of instability or disequilibrium and that the sales of Government securities in the secondary market did not show a long-run effect in Nigeria. Nnanna (2002), also examines the impact of monetary policy on exchange rate stability in Nigeria using the vector autoregressive (VAR) model for the period, 1993Q1–2001Q4. The study identified the determinants of exchange rate performance to include, liquidity (proxied by base money), intervention rate, (proxied by Treasury bill rate), price level (proxied by inflation rate), foreign or external reserves, and the parallel market rate. The study found that exchange rate variability in Nigeria was a result of adverse monetary policy implementation. The failure of monetary policy was linked to the fiscal dominance of the Government sector. Kure et al. (2019) used the autoregressive (VAR) method to examine the effects of the CBN balance sheet on the growth of credits, economic growth and price stability between 2006 and 2017. They found that CBN policies (balance sheet) have been effective in influencing monetary policy outcomes (such as reducing the cost of credits (interbank rates), increasing bank lending (credits) to the private sector and economic growth and decreasing inflation) in Nigeria. They further showed that the magnitude of the policy's effects favoured asset dispersion (credit easing against growth in assets (quantitative easing). Bulusu (2020) explained the rationale behind the Central Bank's public announcements of OMO in Canada. The paper found that the public announcement of OMOs improves transparency in the open market by making the price of overnight credits or liquidity remains at the desirable level and also influences economic agents' decision-making processes in the demand and supply of liquidity in the economy. Such announcements are expensive because they moderate the impact of changes in the money supply through OMOs. Similarly, Demiralp and Jorda (2001) investigated the announcement effects of the Federal Reserve's OMO in the United States using the Tobit regression analysis. They found that the response to an unusual event (such as a Federal fund target change announcement that constituted a reversal in the direction of previous changes) becomes stronger as the maturity of the term rate considered increases in the United States. The response to the target change is weaker as long as these changes follow the same general direction as previous changes in the open market.

Bassey et al. (2018) used ordinary least squares to investigate the effectiveness of OMO instruments of monetary policy in Nigeria. The paper found a significant relationship between monetary policy instruments (such as OMO required reserve ratio and monetary policy rate) and broad money supply in Nigeria. However, Aliyu (2005) assessed OMOs and macroeconomic stability in Nigeria using the co-integration and error correction modelling from 1970 to 2004. The paper found Treasury bill intervention to be positive and significant in influencing the rate of interest through the prices of bonds in the open market. The paper established a long-run relationship between OMO and monetary policy stability in Nigeria. Also, Onwumere et al. (2012) used ordinary least squares to examine the impact of OMO on price stability from 1993-2007. The paper reported a positive correlation between OMO and price stability in Nigeria. In another study, Carli and Gomis-Porqueras (2020) employed a monetary, frictional and incomplete market framework where agents face stochastic trading opportunities, anonymity and limited commitment, to examine the effects of OMO in the economy. They found that when public debt exhibits liquidity premium, OMO has real effects on the economy. They argued that

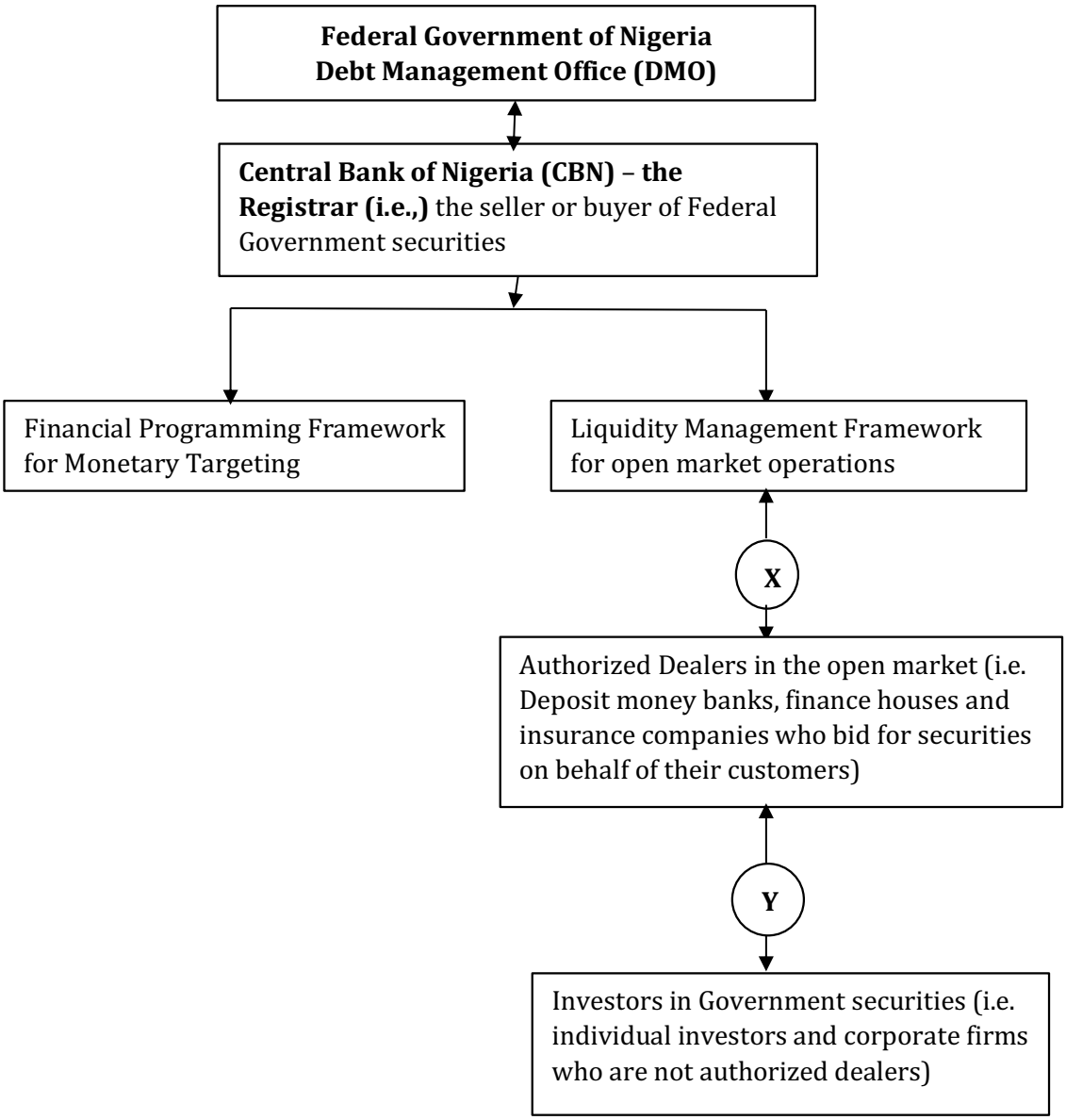
the effects are direct consequences of OMO changing the endogenous borrowing constraints that buyers face in unsecured credit transactions. A purchase of government securities can increase or decrease interest rates depending on the stationary monetary equilibrium in the economy. Bustamante (2021) used a general equilibrium search-theoretical model to study the distributional effects of OMO and its transmission mechanism. The paper found that OMO policy that targets nominal interest rates requires increases in the relative supply of bonds or instruments, and raising the ability of agents to self-insure against potential shocks. The increased supply of bonds reduces the concentration in asset holding and total wealth and also increases the ability of agents to self-insure against liquidity risks. This will result in a fall in inequality and a reduction in the inefficiencies arising from decentralized trading in the open market. This leads to improved welfare benefits for agents who are relatively poor and constrained by liquidity. The paper further revealed asymmetries in the responses of economic output to OMO. The asymmetry is higher on the size of OMO when targeting interest rate hikes than interest rate contraction. From the review of the literature, the studies were centred on finding causal links between OMO or exchange rate policy and monetary policy or bank reserves or broad money supply or interest rate in Nigeria. Still, some of the studies were interested in explaining the volatility or spikes in OMO sales. However, the impact of CBN credits to the Federal Government on the effectiveness of OMO as a tool of monetary policy was ignored by past studies in Nigeria. This paper is a step in this direction.

Theoretical Framework and Methodology

The theoretical framework for a market-based monetary policy control technique is generally (but not solely) based on the relationship between money supply and the based money (Ojo, 1999; Nnanna, 2002). We modified equation (19) and empirically examined the impact of CBN credits on OMO sales in Nigeria. The theoretical framework for the conduct of OMO in Nigeria has its roots in CBN's core mandate of maintaining price stability, promoting economic growth and sustaining a virile balance of payments position (Omanukwue & Abeng, 2008). Open market operation in Nigeria is conducted by the CBN through the Banking Operations Departments (BOD). The CBN OMO was initially conducted with discount houses only. However, the dealership in the open market was later extended to the banking and non-banking public money market dealers. As noted earlier, two types of transactions exist in Nigeria, namely: permanent or outright transactions and temporary or self-reversing transactions. The instruments traded in Nigeria are predominantly Treasury Bills. The pricing of instruments in the open market is based on Dutch Auction System, (DAS). In Figure 1, the permanent transactions are represented by letter X where Federal Government securities are bought and sold on an auction basis to authorized dealers. Here the CBN deals directly with the authorized dealers who intermediate between the investors in Government securities and the CBN. However, temporary transactions are represented by letter Y. Secondary transactions normally take place at this stage in which investors in Federal Government securities deal directly with authorized dealers.

Figure 1

Open market operations transaction framework

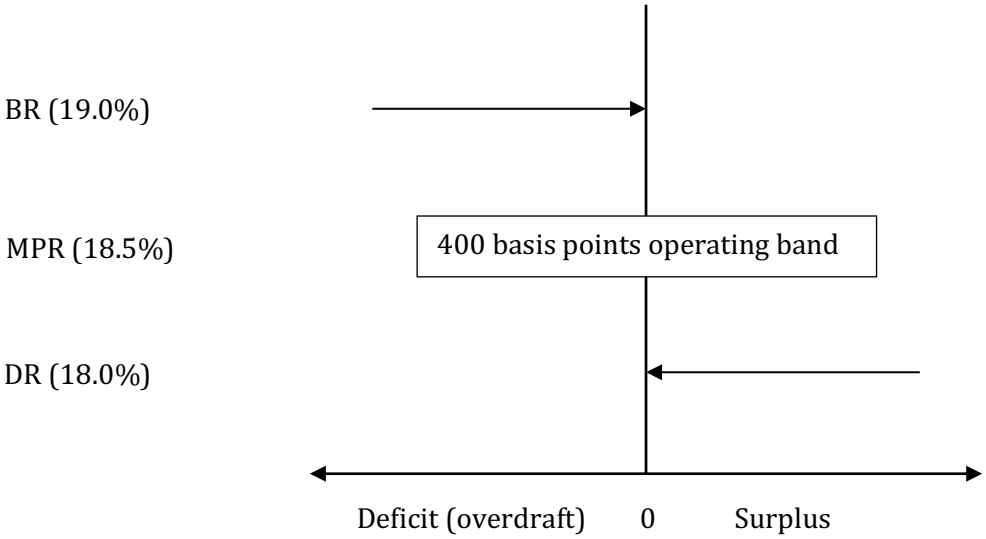


Source: Author's own development

The entire operating band corridor had a width of 400 basis points with the MPR at the centre, (Okafor, 2009). The CBN still uses the framework but sometimes changes the operating band to reflect the prevailing economic conditions in the country. The operating band is shown in Figure 2. It will be therefore considered the spread or gap between lending rates and the deposit rates for this paper. The overnight lending rate target is thus, for example, determined as OBB* = MPR + 2 basis points, while the overnight borrowing rate is the actual open buy-back rate (OBB). The difference between them is the overnight interest rate gap or spread. This will help ensuring that interest rate variations in the open market are responsive to monetary policy interest rate changes. Therefore, the theoretical framework for OMO in the paper is anchored on the money supply model as the operating model (Nnanna, 2003; Ojo, 1999) vis-à-vis the Financial Programming Framework.

Figure 2

CBN's operating band for overnight interest rates



Source: Adopted from Okafor (2009) and CBN (2023). Note that: MPR = monetary policy rate, BR = borrowing rate, and DR = deposit rate.

Model Specification

Two equations are of interest in this study, i.e. the Federal Government credit and OMO sale models which are autoregressive of order one (AR (1)).[1] That is, the functional forms of the mean equations and the conditional variance equations of the credit and OMO, models, follow GARCH (1, 1) modelling pattern. The Federal Government's fiscal dominance in the Nigerian economy depends on the size of its fiscal budget deficits. The mean equation, equation (20), shows that CBN credits to the Federal Government, ($CBNCG_t$) depend on a set of exogenous variables and an autoregressive process of order one. The conditional variance equation (21) is a function of the mean, (c), the ARCH term, (ε^2_{t-1}) and the GARCH term, (δ^2_{t-1}). The sum of the ARCH and GARCH terms' parameters (i.e. $\alpha + \beta < 1$) explains the news about volatility from the lag period and the lag period forecast variance respectively.

$$CBNCG_t = \propto_0 + \beta_1 FD_t + \beta_2 OMO_t + \beta_3 DBR_t + \beta_4 RGDP_t + \beta_5 PT_{t-1} +$$

$$\beta_6 EXR_t + \beta_7 IRG_t + \beta_8 AR(1) + U_t \ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots (20)$$

The conditional variance of the model is given as;

$$\delta_t^2 = c + \propto \varepsilon_{t-1}^2 + \beta \delta_{t-1}^2 \ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots (21)$$

Where; $CBNCG_t$= Net CBN credits to the Federal Government at time t; FD_t= fiscal budget deficits of the government at time t, OMO_t= open market operations sales at time t, DBR_t= Deposit money bank reserves at time t; $RGDP_t$ = real GDP at time t, PT_t = general price level proxied by consumer price index at time t, EXR_t = exchange rate at time t; IRG_t = Interest rates gap (i.e.(MPR_t +2) – OBB rate) at time t; MPR_t = Monetary policy rates at time t; OBB_t = Open buy back rates; AR(1) = Autoregressive component/variable of order one (1); U_t= Error terms of the conditional mean equation at time t; $\propto_0$= the constant term, $\propto_i$= coefficients of FD_t OMO_t, DBR_t, $RGDP_t$, PT_t EXR_t, IRG_t and AR(1) respectively, (where, i = 1, 2, ..., 8); ε_t= error disturbance term of U_t at time t; c = the constant/mean term; ε_{t-1}^2= lag values of the squared residuals from the mean equation i.e. the ARCH term; δ_{t-1}^2= lag period forecast

[1]*Although the AR (1) component (which is the serial correlation coefficient) may weaken the strength of the estimates, they are however equivalent to the maximum likelihood estimates and are asymptotically unbiased and efficient estimates.*

variance, i.e. the GARCH term; δ_t= the conditional variance at time t. The variance of the error term which follows a normal distribution with zero mean and unit variance that follows an autoregressive process of order one (i.e. AR (1));

In equation (20), $\propto_6 \ and \propto_7$ are expected to be negative (i.e. $\propto_6 \ and \ \propto_7 < 0$) because Federal Government borrowing reduces when exchange rates appreciate and the interest rates gap increases in the economy. However, $\propto_1, \propto_2, \propto_3, \ \propto_4$ and $\propto_5$ are expected to be positive because Federal Government borrowing increases as budget deficits, OMO, deposit money bank reserves, real GDP and general price level increases in the economy.

The Open Market Operations Model. OMO sales are specified to depend on the Federal Government's fiscal operations (CBN credits to the government) and other exogenous variables that follow an autoregressive process. From the theoretical framework, the OMO model (i.e., equation (22)) shows that OMO_t depends on CBN credit to the Federal Government, deposit money bank reserves, real GDP, general price level, exchange rates, interest rates gap and an autoregressive process of order one. The conditional variance, (i.e., equation (23)) is also specified below the conditional mean equation.

$$OMO_t = \propto_0 + \ \beta_1 CBNCG_t + \beta_2 DBR_t + \ \beta_3 RGDP_{t-1} + \beta_4 PT_{t-1} + \beta_5 EXR_t + \ \beta_6 IRG_t + \ \beta_7 AR(1) + \ U_t \ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots (22)$$

The conditional variance of the model is also given as;

$$\delta_t^2 = c + \propto \varepsilon_{t-1}^2 + \beta \delta_{t-1}^2 \ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots (23)$$

Therefore, in equation (22), $\beta_4, \ \beta_5 \ and \ \beta_6$ are expected to be negative (i.e., $\beta_4, \ \beta_5 \ and \ \beta_6 < 0$) because the effectiveness of OMO increases as general price level, exchange rates and interest rate gap in the economy decreases. However, $\beta_1, \ \beta_2$, and β_3 should be positive because as OMO increases, CBN credit to the Federal Government or fiscal deficits of the Federal Government, deposit money bank reserves and real GDP also increase. The autoregressive component increases the effectiveness of OMO sales and its significance will show the appropriateness of the models.

Sources and Scope of Data

The data were obtained from the publication of the Central Bank of Nigeria. Their publications such as statistical Bulletins and Annual Report and Statements of Accounts of various issues were used. The data covered the period 1993Q1 to 2021Q4. The data were specifically collected on CBN credit to the Federal Government, fiscal deficits, open market operation sales, bank reserves, capital and reserves of discount houses, monetary policy rates and open buy-back rates.

Estimation Technique

The study ran the stationarity test in order to avoid spurious regression often attributed to non-stationary time series data which according to Gujarati and Porter (2008) are misleading and make predictions unreliable. The stationarity test was conducted noting the order of integration of all variables of the model using the Augmented Dickey-Fuller (ADF) and the Philip Perron (PP) tests. The general ADF and PP tests equation is specified as follows:

$$\Delta InY_t = \ \gamma_0 + \ \delta InY_{t-1} + \sum_{i=0}^{n} \pi_i \, \Delta InY_{t-i} + \varepsilon_t \ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots (24)$$

Where; Δ = first difference operator, t = the trend variable, InY_t= logarithms of Y_t, the variable under consideration;π_i= coefficient of the test variable, $\sum_{i=0}^{n} Y_{t-i}$ = sum of lagged variables of Y_{t-1} from i = 1, 2, ., n values and ε_t = white noise error term. Usually, a null hypothesis (H_0) of unit root is rejected if the ADF and PP statistics are greater than the Mackinnon critical values at a chosen level of significance. The lag length is strictly an empirical issue based on the various information selection criteria.

Financial time series data such as OMO, prices, output level, fiscal deficits, etc. are characterised by a phenomenon known as volatility clustering. There are periods in which the data show a wide swing over the period and followed by relative calm in other periods, (Gujarati & Porter, 2008). The ARCH and GARCH model is an estimation technique that explains the conditional variance or volatility of a variable. Therefore the ARCH and GARCH model is used to explain investment risk associated with an asset or the value of an asset and to obtain more efficient estimators if heteroscedasticity in the error terms is properly handled. Therefore, an ordinary ARCH model is a special case of a GARCH specification (i.e. GARCH (1, 1)) in which there are no lagged forecast variances in the conditional variance equation, (Gujarati & Porter, 2008). The study estimated the models specified using econometric views (i.e. e-views version 10.0). The study tested for further ARCH effect in the models' residuals using the ARCH LM Test. Ignoring the ARCH effect may result in a loss of efficiency of the estimates. We, therefore, test the null hypothesis that there is no ARCH effect in the residuals. The null hypothesis is usually rejected if the computed F-statistic and Obs*R-squared statistic probabilities are less than the 5% probability of committing type one error. More so, the study also analysed the estimated models and investigated their forecasting abilities.

Research Results

Unit Root Test Result

The unit root test examined the stochastic properties of the data and the results were summarised in Table 2. The ADF test for almost all the variables under investigation accepted the hypothesis that there existed a unit root in the variables. This indicated that the data were non-stationary. This implies the ADF and PP statistics for OMO_t, DBR_t, $RGDP_t$, EXR_t, IRG_t, FD_t and $CBNCG_t$ are integrated of order one (i.e. I (1)) while PT_t is integrated of order two (I(2)) using both the ADF and PP tests.

Table 1

Unit root test result for variables

Variable	Factor	ADF Test		Order of Integration	PP Test	
		ADF Statistics	5% critical value		PP Statistic	5% critical value
OMO_t	C	-9.9828**	-2.8872	I(1)	*-11.993***	*-2.8869*
DBR_t	C	-4.4782**	*-2.8882*	I(1)	*-9.3876***	*-2.8869*
$RGDP_t$	C	-10.755**	*-2.8869*	I(1)	*-10.755***	*-2.8869*
$CBNCG_t$	C	-8.7548**	*-2.8869*	I(1)	*-15.919***	*-2.8869*
IRG_t	C	-11.274**	*-2.8869*	I(1)	*-12.360***	*-2.8869*
FD_t	C	-10.554**	*-2.8869*	I(1)	*-10.557***	*-2.8869*
PT_t	C	-13.483**	-2.8877	I(2)	*-17.759***	*-2.8872*
EXR_t	C	-9.1095**	*-2.8869*	I(1)	*-9.0646***	*-2.8869*

Source: Author's Computation. Note that: C = intercept,** = significant at 5% levels.

The Impact of Fiscal Deficits on CBN Credits to the Government

The results of the credit models are presented in Table 3 of the paper. The results showed that the coefficient of fiscal deficits met the a-priori expectation of the model and was also significant at a 5 per cent level. This suggests that fiscal deficits rise or fall as CBN credit to the Federal Government rises or falls. That is to say that when the Federal Government increases the fiscal budget deficit by ₦1 million, CBN credit to the Federal Government will increase by ₦1,482.32 million in Nigeria. The OMO sales coefficient did not meet the a-priori expectation of the model but was significant at a 5% level. As OMO sales increase by ₦1 million, CBN credit to the government decreases by ₦84.49 million in Nigeria.

Table 2

Results of CBN credit to the government (dependent variable $CBNCG_t$)

Variables	Coefficients	z-statistics	p-value
C	-1.07×10^{9}**	-11.344	0.000
FD_t	1482.32**	4.946	0.000
OMO_t	-84.488**	-5.784	0.000
DBR_t	-116973.2**	-5.322	0.000
$RGDP_t$	11351.02**	9.996	0.000
PT_{t-1}	-409035.0**	-3.638	0.000
EXR_t	8147739.0**	9.475	0.000
IRG_t	11193109.0**	5.692	0.000
AR (1)	0.039	0.315	0.753
Variance equation			
C	9.84×10^{14}	1.421	0.155
ARCH (1)	0.428**	4.898	0.000
GARCH (1)	0.478**	3.845	0.000
R^2 = 0.2160; Adj. R^2 = 0.1563; D.W. Stat. = 0.6225; Akaike info criterion = 40.979; Schwarz criterion = 41.267; Inverted AR roots = 0.04			

Source: Author's Computation. Note that: ** = significant at a 5% level.

The credit model also revealed that real GDP, general price level, official exchange rates and interest rate differences or gaps are significant determinants of CBN credits to the government in Nigeria (see Table 3 for detailed results). However, the coefficient of deposit money bank reserves was significant at a 5% level but did not meet the a-priori expectation of the model. This means that as deposit money bank reserves increase by ₦1 million, CBN credit to the Government decreases by -₦116,973.2 million. The wrong signs of the deposit money bank reserves coefficients could be due to the high cost of borrowing in banks that made the Federal Government seek cost-effective loans from abroad. Also, data deficiency and the monetization of oil revenue have made the Federal Government a net creditor to the CBN. The coefficient of real GDP met the a-priori expectation but that of the general price level, exchange rate and interest rate gap did not but were all significant at the 5 per cent level. The table also revealed that an increase in CBN credits to the federal government by ₦1 million, real GDP grew by ₦11,351.02 billion, the one-period lag general price level decreased by 409,035.0 units, the exchange rates rose by ₦8,147,739.0 and the interest rate spread increases by 11,193,109.0 percentage points.

The R^2 of 0.2160 implies that only 21.60 per cent of the variations in CBN credit to the Federal Government are explained by variations in fiscal deficits, deposit money bank reserves, OMO sales, real GDP, general price level, exchange rates and interest rate spread in Nigeria. The Durbin-Watson statistics suggested the presence of ARCH effects or autocorrelation in the residuals of the model. The inverted AR root of 0.04 showed that the model is stationary since it is less than one. The ARCH and GARCH coefficients in the conditional variance equation are statistically significant at a 95 per cent confidence level. The sum of the ARCH and GARCH effect in the above result (i.e. 0.4275 + (0.4779)) is 0.9054 suggesting that volatility in CBN credit to the Federal Government is persistent. This suggests that fiscal deficits of the Federal Government may not have reduced the distortions and speculative behaviour in the CBN credit market in Nigeria.

Impact of CBN Credits to Government on Open Market Operations

One period lag was imposed on real GDP and the general price level in estimating the OMO sales model to give room for adjustments in periods of high volatility. The coefficient of CBN credits to the Federal Government did not meet the a-priori expectation but was significant at a 5% level. This means that if CBN credits to the Government were increased by ₦1 million, OMO sales would decrease by

₦0.000527 million in Nigeria. This means that CBNCGt had a significant negative impact on the effectiveness of OMO in Nigeria. The coefficient of deposit money bank reserves did not meet the a-priori expectation but was also significant at a 5% level of significance. That is when the deposit money bank reserve increases by ₦1 million, OMO sales will decrease by ₦823.83 million. This suggests that deposit money banks' reserves had a significant negative impact on the effectiveness of OMO sales in Nigeria. However, the coefficient of one-period lag real GDP met the a-priori expectation and was significant at a 5% level. It suggests that when real GDP increases during the last quarter, the current effectiveness of OMO sales also increases in Nigeria. Table 4 also indicated that the general price level had a significant positive effect on the effectiveness of OMO in Nigeria. The findings are consistent with Onwumere et al (2012) who reported a positive correlation between OMO and price stability in Nigeria.

The coefficient of official exchange rates met the a-priori expectation and was also significant at the 5% level. If the official exchange rate is increased or depreciated by ₦1, the effectiveness of OMO sales will reduce by ₦647.71 million in Nigeria. The coefficient of the interest rates gap did not meet the a-priori expectation but was significant at a 5% level of significance. Therefore, the lower the interest rate spread, the greater the effectiveness of OMO in Nigeria. The AR (1) coefficient was significant at a 10% level suggesting that the model is good. The coefficient of determination (R2) of 0.5366 implies that about 53.66 per cent of the variations in OMO sales are explained by variations in CBN credits to the government, deposit money bank reserves, real GDP, general price level, exchange rates and interest rate spread in Nigeria.

Table 3

Results of impact of open market operations in Nigeria

Variables	Coefficients	z-statistics	p-value
C	-1338078.0**	-5.864	0.000
$CBNCG_t$	-0.00053**	-2.617	0.009
DBR_t	-823.83**	-5.822	0.000
$RGDP_{t-1}$	6.71**	3.167	0.001
PT_{t-1}	31127.85**	8.078	0.000
EXR_t	-647.71	-0.391	0.696
IRG_t	17089.86**	3.043499	0.002
AR (1)	0.164***	1.784	0.074
Variance equation			
C	3.14×10^9	0.633	0.527
ARCH (1)	0.427**	2.497	0.013
GARCH (1)	0.576**	4.190	0.000
R^2 = 0.5366; Adj. R^2 = 0.5059; D.W. Stat. = 0.9033; Akaike info criterion = 29.5872; Schwarz criterion = 29.8512; Inverted AR roots = 0.16			

Source: Author's. Note that: **&*** = significant at 5% and 10% level respectively.

The Durbin-Watson statistics suggested the presence of ARCH effects or autocorrelation in the residuals of the model. The inverted AR root of 0.16 showed that the model is stationary since it is less than one. The sum of the ARCH and GARCH effect in the above result (i.e. 0.4270 + 0.5757) is 1.0027 suggesting that volatility in OMO is persistent. The study conducted the ARCH LM Test of the residuals in the credit and OMO Models. The result in Table 5 accepted the null hypothesis of no ARCH effects in the residuals at a 5% level. The credit and OMO models indicated that there are further ARCH effects in the residuals.

Table 4

Diagnostic test of residuals (ARCH LM test)

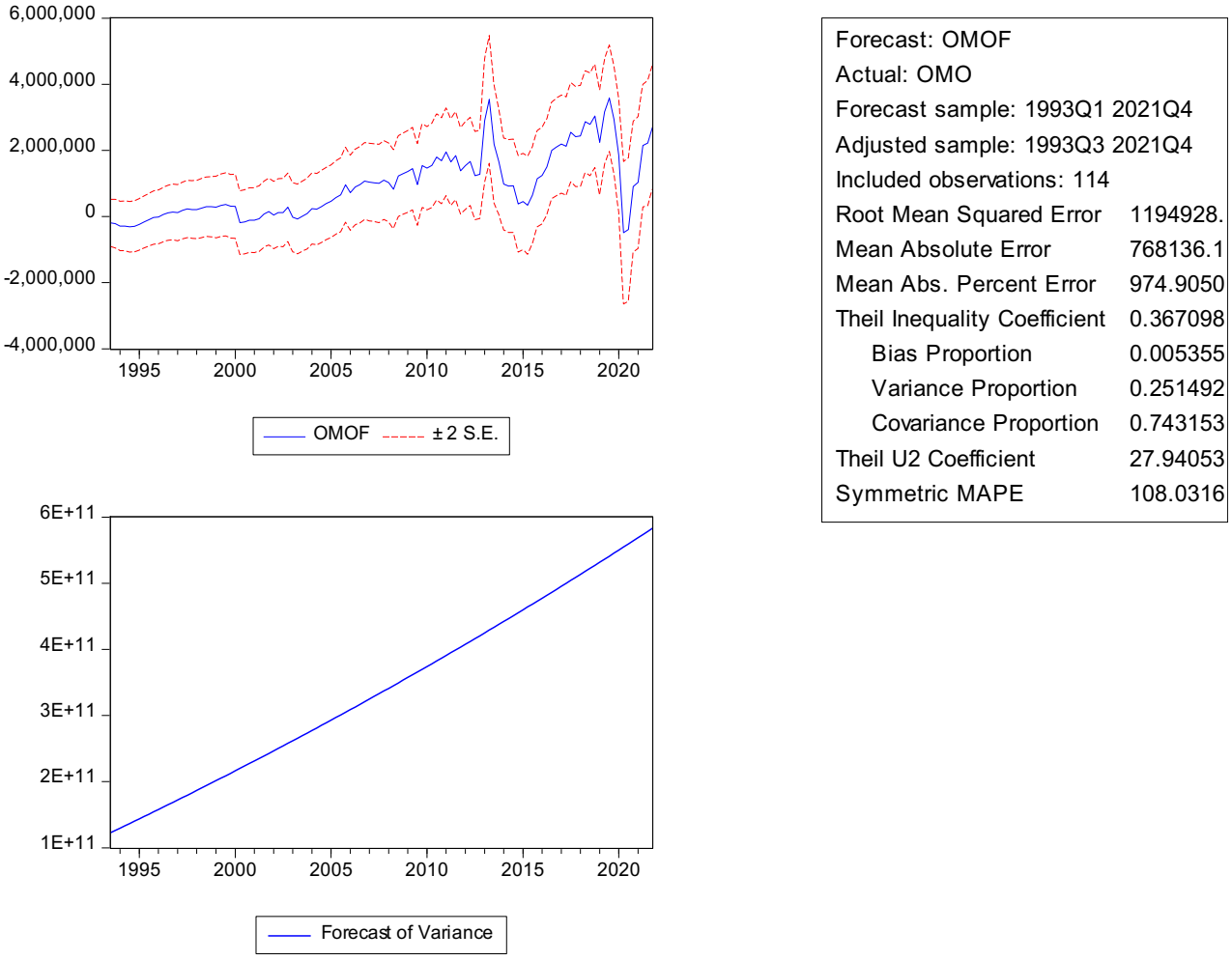
Test Statistic	Credit Model	OMO Model
F-Statistic	1.9289	0.6182
Probability	0.1676	0.4334
Obs* R-squared	1.9301	0.6259
Probability	0.1647	0.4289

Source: Author's Computation.

The forecast graph in Figure 2 is derived from the mean equation together with two standard deviation bands. Also, the graph next to it is the conditional variance, δ_(t-1)^2graph. Since the sum of the ARCH and GARCH terms is greater than half (0.5), the volatility shocks on OMO are persistent, so that the forecast of the conditional variance converges to a steady state quickly. The findings are consistent with Lee (1983) who reported that OMO has the effect of always returning to its steady-state paths in the long run. The Theil inequality coefficient is close to zero suggesting that the forecasted model has a good fit. This is supported by small bias and variance proportions so that most of the bias is concentrated on the covariance proportion.

Figure 2

Forecast of open market operations model



Source: Author's computation.

Discussion

The first research question showed that fiscal deficits had a significant positive impact on CBN credit to the Federal Government of Nigeria. Fiscal deficits were significant at a 5 per cent level. The finding is similar to Umaru et al. (2021) who reported that Government budget deficits positively influence economic growth in Nigeria. The finding is contrary to Kumar and Baldacci (2010) who reported that fiscal deficits and public debt have a significant positive impact on long-term interest rates on bond yields. Also, the second research question means that the Central Bank's credit to the government had a significant negative impact on the effectiveness of OMO in Nigeria. It was validated at a 5 per cent level of significance. The finding is contrary to Aliyu (2005) who reported that Treasury bill intervention positively influences the rate of interest through the prices of bonds; Bassey et al. (2018), who reported a significant positive relationship between OMO and broad money supply; Onwumere et al. (2012) who reported a positive correlation between OMO and price stability; Carli and Gomis-Porqueras (2020) who reported that the effects of OMO are a direct consequence of OMO changing the internal borrowing constraints that buyers face in unsecured credit transactions in the economy and Bustamanate (2021) who reported that the increase in the supply of bonds reduces agent's asset holding and total wealth concentrations and also enhances the ability of agents to self-insure against liquidity risks The findings remain the main contribution of this paper to the literature.

Therefore, the research results suggest that fiscal deficits rise or fall as CBN credits to the Federal Government rise or fall in Nigeria. That is consistent with economic theory which established a significant positive relationship between fiscal deficits and lending through CBN credit to the Government. In macroeconomic management, the CBN may be unable to control the growth of credits to the Government (as noted by Ojo (1999)) due to fiscal dominance, thereby causing potential threats to effective OMO, liquidity management condition, price stability and real output or GDP growth. Thus, as CBN credits to the Government increases, the effectiveness of OMO sales decreases. Conversely, when the CBN credits to the government decreases, the effectiveness of OMO increases. In economic theory, credits or lending to the Government increases the amount of liquidity in circulation because it stimulates or increases public expenditure and hence the need for CBN to sell securities through OMO sales to mop up the excess volume of money in circulation. However, the evidence in this study suggested otherwise. Also in practice, however, Government fiscal operations in the form of rising fiscal budget deficits and Central bank's credits to the Government may exert a significant positive effect on the effectiveness of OMO sales. This will depend on deposits money bank reserves and public investments interest in the open market. In practice, a rise or fall in deposit money bank reserves is associated with an increase or decrease in OMO sales and hence an improvement in the effectiveness of OMO. Exchange rate depreciation encourages exports and at the same time discourages the importation of unwanted goods that put pressure on the general price level. The exchange rate depreciation reduces the effectiveness of OMO through imported inflation that comes with the inflow of foreign portfolio investments. Similarly, a wide interest rate spread may reduce the effectiveness of OMO in Nigeria especially when the monetary policy rates are high and the rate of return on investments is low. The evidence showed that volatility is persistent in the Nigerian open market for treasury bills. The volatility suggests that the CBN credits to the Federal Government have not eliminated or reduced the distortions and the speculative behaviour of investors in the Government securities market in Nigeria. However, the distortions and speculative behaviours in the open market converge to a steady state quickly, implying that OMO sales are an effective tool of monetary policy in Nigeria. In the short run, OMO instruments may exercise a more effective influence on the interest rate than exchange rate instruments. The effectiveness of OMO may depend on changes in investment in the open market while at the same time, changes may occur in exchange rates through the trade balances.

Conclusions and Implications

The findings of the study suggest that the Federal Government decisions on credits and fiscal deficit have a significant impact on the use of OMO in Nigeria. The Federal Government's fiscal dominance sometimes complicates the task of liquidity management and reduces the effectiveness of OMO sales in managing liquidity. But, the performance of OMO can be more effective, if the Central Bank and can influence, if not regulate Government accounts with the bank. A fluctuation in the Government accounts (as in the case of frequent credit or borrowing from the banking system) with the Central Bank affects the supply of bank reserves in the economy. CBN should advise the Federal Government to comply with the statutory limit of ways and means of advance. Therefore, with less Government fiscal dominance, OMO would have a greater chance of stabilizing monetary aggregates.

The study policy implications include the following:

I. The Federal Government should reduce its fiscal dominance by sustainably controlling fiscal budget deficits and borrowing from the banking system (especially CBN) to enhance the growth and investments in the open market.
II. The Federal Government should also stabilise exchange rate regimes to encourage more investments in the open market.
III. The CBN should incorporate the FGN bond instrument in OMOs in Nigeria. The CBN should continue with its instruments (CBN bills) and still incorporate the Federal Government of Nigeria bond instrument and create more instruments for OMO. The CBN could increase or deepen the scope and number of Government securities or debt instruments in the open market. The instruments will provide temporary support to the existing instruments for effective OMO and liquidity management. More participants and investors should be encouraged to keep excess liquidity under control.
IV. The real sectors of the economy should be properly funded by the CBN to provide support for open market instruments in monetary policy stabilisation in Nigeria.
V. The public awareness is needed for public investments in the open market to ensure effective liquidity management in Nigeria.

Suggestions for Future Research

The study made the best use of the available collected data. However, there are limitations in finding exact quarterly data for some variables in some years. However, this limitation was surmounted when the exact annual data was converted to quarterly data by the paper. The paper proposes that researchers should explore the potential OMO instruments that could deepen monetary policy stability and liquidity management in Nigeria.

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Conflict of Interest

None.

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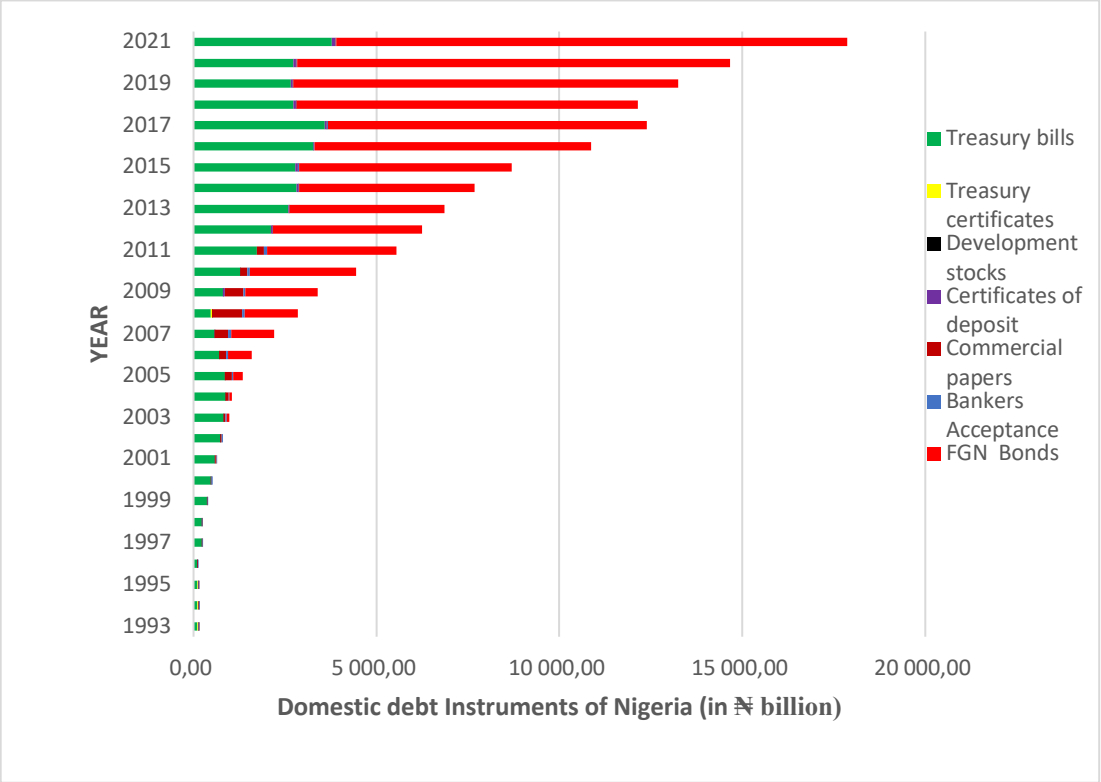
Appendix 1

Figure

Stacked value of money market instruments in Nigeria



Source: CBN (2021).