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Shocks to Monetary Policy Instruments: Does Credit to the Private Sector Respond in a Similar Manner to Public Sector Credit in Nigeria? A Vector Autoregressive Approach

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Abstract

This paper aims to investigate the response of private and public sector credit to shocks in monetary policy instruments with a view to ascertaining if the responses differ. The study utilized the vector autoregressive (VAR) model with monthly data covering the period from 2010M1 to 2021M8. Findings show that credit to private sector responds positively to shocks in money supply and monetary policy rate (MPR) in all periods. However, the response to cash reserve requirement (CRR) was negative beginning from period five, and it also responded negatively to foreign interest rate shock. On the other hand, credit to government was found to respond positively to shocks in money supply up to period two and CRR in all the periods, but it responded negatively to MPR starting from period three. The results of the variance decomposition show that other than shocks to itself, which was 100% in the first period, shocks to other variables influence private sector credit. Also, other than shocks to itself, which was 99.89% in the first period, shocks to other variables lead to shocks to credit to government. We therefore recommend that policies used to influence financial intermediation should factor in the sensitivity of both public and private sectors to these policy instruments and the impact of exogenous shocks should be factored into policy formulation.

Keywords: Credit to private sector, Credit to government, Money supply, Monetary policy, Cash reserve requirement, VAR.
JEL Classification: C53; E51; E52; H74.

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Ethical: This study followed all ethical practices during writing.

Contents

Contribution of this paper to the literature
This study contributes to the existing literature by splitting credit provision into private and public sector and investigating how tools of monetary policy shapes the behavior of credit to each sector.

1. Background to the Study

Credit provision to both the government and the private sector is essential for the running of an economy owing to the fact that, for the government, projected revenue rarely matches expenditure, and for the private sector operators, access to funds is usually a herculean task mostly in developing countries such as Nigeria. The roles of banks in credit provision through their intermediation activities cannot be over-emphasized. In playing these roles, they source funds from surplus units (lenders) which they lend to deficit units (borrowers). Such financial intermediation roles have been noted to promote economic growth as funds, which would otherwise lie idle, are put to productive use. However, before this intermediation role becomes effective, the role of interest rate is recognized. A borrower pays to borrow money over an agreed period of time from a lender, and interest rates influence the lending behavior of banks. The dilemma that monetary authorities face is how to use monetary policy tools, such as interest rate, to strike a balance between low and high credit provision. This is because low credit provision stifles the economy, while high credit provision has the tendency to raise money supply to a level that could spiral into inflation.

In a bid to influence credit provision, monetary authorities employ monetary policy tools to achieve this and other macroeconomic objectives. Monetary policy is a deliberate action of monetary authorities designed to achieve certain economic objectives through the regulation of the quantity, cost and availability of money and credit (Central Bank of Nigeria, 2016). Nyong (2011) noted that "these arrangements are designed in lieu of the legal framework that is in place to govern the financial practices of banks and, consequently, influence the availability of financial resources." Among the objectives of monetary policy, price stability has of recent become very prominent and is the reason Nigeria has embraced inflation targeting as a key monetary policy thrust. In Nigeria, monetary policy action is implemented through the Central Bank of Nigeria (CBN), which is the apex bank. In order to achieve the monetary policy objectives, the central bank usually uses indirect means, which involves choosing the tools or instruments they can directly control (Central Bank of Nigeria, 2016). According to the report, among the instruments at the disposal of the bank are monetary policy rate, open market operation (OMO), reserve requirements, selective control and moral suasion. To achieve the goals of monetary policy, instruments of monetary policy are directed at target variables. These targets could be operating targets such as short-term interest rate and aggregate reserves (monetary base, reserves, etc.) or intermediate targets such as monetary aggregates (M1, M2) and aggregate demand (Central Bank of Nigeria, 2016). The CBN uses its monetary policy instruments to hit the operating targets in order to hit the intermediate targets with a view to achieving its objective.

With monetary policy tools, the CBN can influence credit extension through the use of interest rate, which is geared towards adjusting the lending rates of deposit money banks and other financial institutions. A major issue this study aims to investigate is the behavior of credit provision arising from shocks to monetary policy instruments. Nigeria is an open economy that is integrated with other economies. Therefore, apart from domestic factors that could introduce dynamism in the economy, exogenous factors could also alter policy choices. For instance, sudden changes in foreign interest rates could influence credit provision, thus influencing the choice of monetary policy instrument. In deploying a particular monetary policy instrument to influence credit provision, it is pertinent to find out how credit to the public and private sectors reacts to the selected monetary policy tools. A policy tool that leads to high interest rate could be inimical to growth because financial institutions, being profit-oriented entities, will take undue advantage of such a development by charging high interest rates to borrowers. These profiteering tendencies will end up raising the cost of capital for investment. Among the major reasons that motivated this study is the unresolved controversy regarding the impact of monetary policy on credit provision in Nigeria. Afolabi, Adeyemi, Salawudeen, & Fagbemi (2018) noted that the transmission process of monetary policy to credit availability is not one-directional in Nigeria. Empirical evidence in Nigeria has equally supported this observation (Adediran, George, Alege, & Obasaju, 2019; Ademokoya, Sanni, Oke, & Abogun, 2020; Adeniyi, Kayode, Sakirat, & Olamide, 2018). Another motivation is lack of research on the behavior of credit to both the private sector and public sector arising from shocks to monetary policy tools. Some earlier related empirical studies have focused on the nexus between monetary policy and credit to the private sector (Osakwe, Okoye, Ezeala, & Okeke, 2022; Udoh, Dauda, Ajayi, & Ikpechukwu, 2021), while others were not specific about the impact of credit to any sector of the economy (Abuka, Alinda, Minoiu, Peydró, & Presbitero, 2019; Afolabi *et al.*, 2018; Onoh & Nwachukwu, 2017). This particular study presents a clear departure from these studies by decomposing the flow of bank financial intermediation into private and public sectors in order to ascertain the behavior of credit to each sector arising from shocks to monetary policy instruments. In Nigeria, this study is more relevant considering that the aftermath of the COVID-19 lockdown, which affected international oil price and other sources of capital inflows, has reduced the revenue profile of the government and thus puts it in a position where it competes with the private sector in sourcing funds in the domestic financial markets. Knowledge of the behavior of credit to each sector will therefore enable monetary authorities to direct the tools of monetary policy in a way that government borrowing does not crowd out private sector borrowing.

1.1. Some Stylized Facts on Bank Credit in Nigeria

Over the years, commercial banks in Nigeria have engaged in the traditional role of financial intermediation by way of assessing funds from surplus units and lending to deficit units. To effectively play this role, adequate capital is necessary. The banking consolidation of 2005, which pegged the minimum capital base of banks in Nigeria from N2 billion to N25 billion, was among the attempts to provide enough liquidity to the banking sector. Figure 1 shows the trend of credit to the government from 2010. Credit to the government began to improve from April 2014 after a previous sharp decline and attained a peak in July 2017 after which it again declined. From October

2018, it began to rise until July 2020 when it experienced a marginal fall and then began to rise again. It should be noted that the quest for government borrowing in Nigeria is mainly spurred by a fall in the international price of oil, which is the mainstay of the country's economy. Thus, as the budget is benchmarked on the projected price of oil, a fall in the price of oil below this benchmark means that the country has to borrow to cushion the shortfall in projected revenue. To support this hypothesis, Figure 2 shows that prior to 2014, oil price experienced a rising trend; however, after 2014 it exhibited a falling trend. A huge fall in oil price occurred in December 2019, and within this period, credit to government rose steeply. The gradual effect of the COVID-19 pandemic cannot be ruled out as being responsible for this phenomenon.

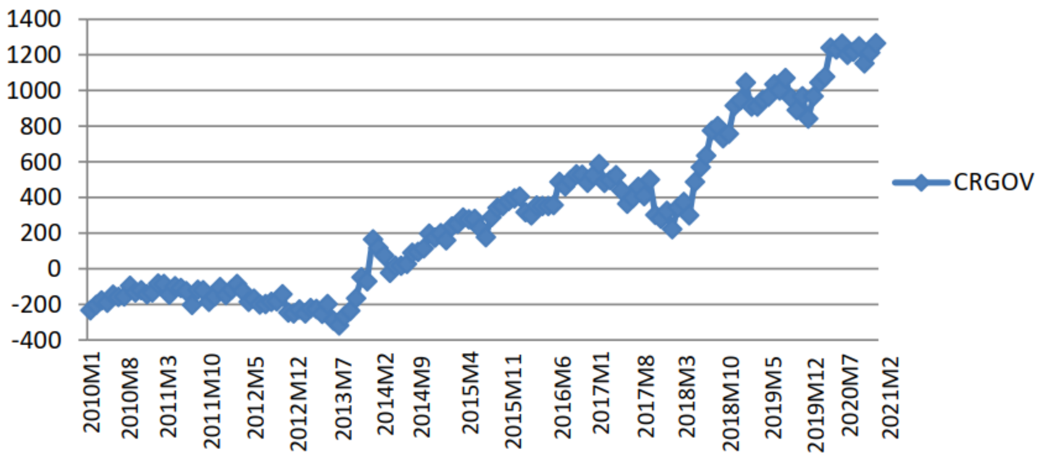

Figure 1. Trend in credit to the government.

Note: CRGOV= Credit to government (Measured in billions of Naira).

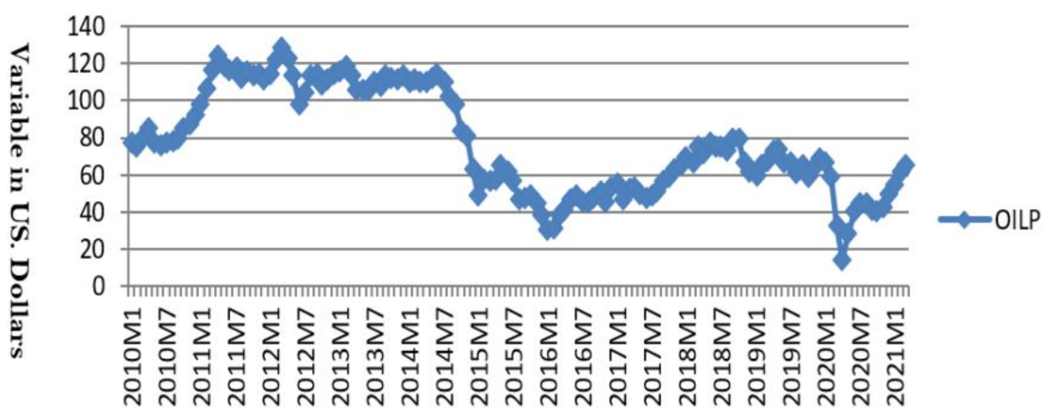

Figure 2. Trend in oil price.

Note: OILP = Oil price.

Figure 3 shows that credit to the private sector experienced a marginal rise all through the sample period, indicating that private sector credit in the country is not encouraging. Several factors have been identified that are responsible for this, among which are the risky environments under which the banks operate which makes them risk averse in extending credit to the private sector, lack of adequate collateral securities on the part of borrowers, and government borrowing through the banks which crowds out private sector borrowing. Figure 4 shows that a strong correlation exists between credit to the private sector and broad money supply (M2) in Nigeria. Such a strong correlation explains the role of money supply in liquidity build-up in banks and how increased liquidity could encourage increased credit extension.

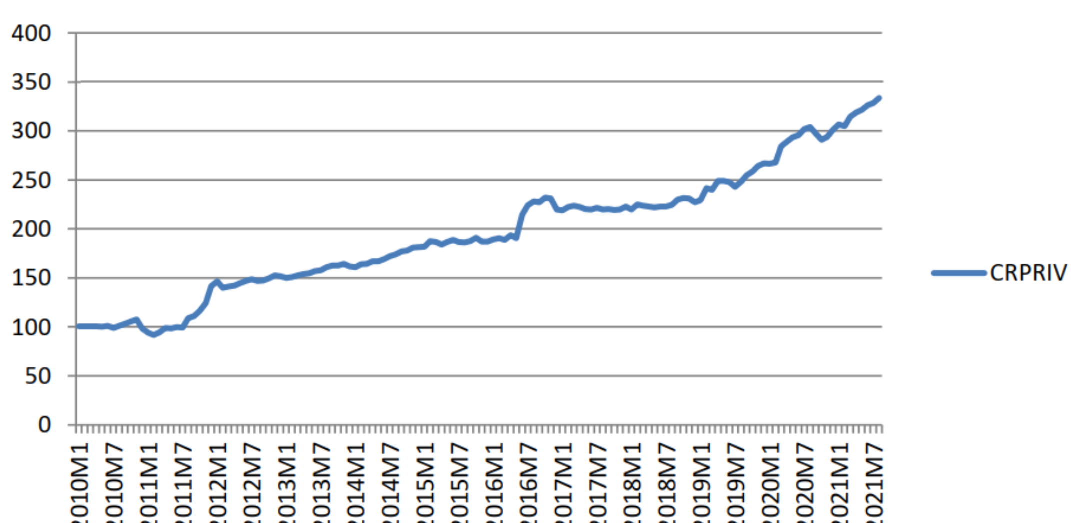

Figure 3. Trend in credit to private sector.

Note: CRPIRV= Credit to private sector (Measured in billions of Naira).

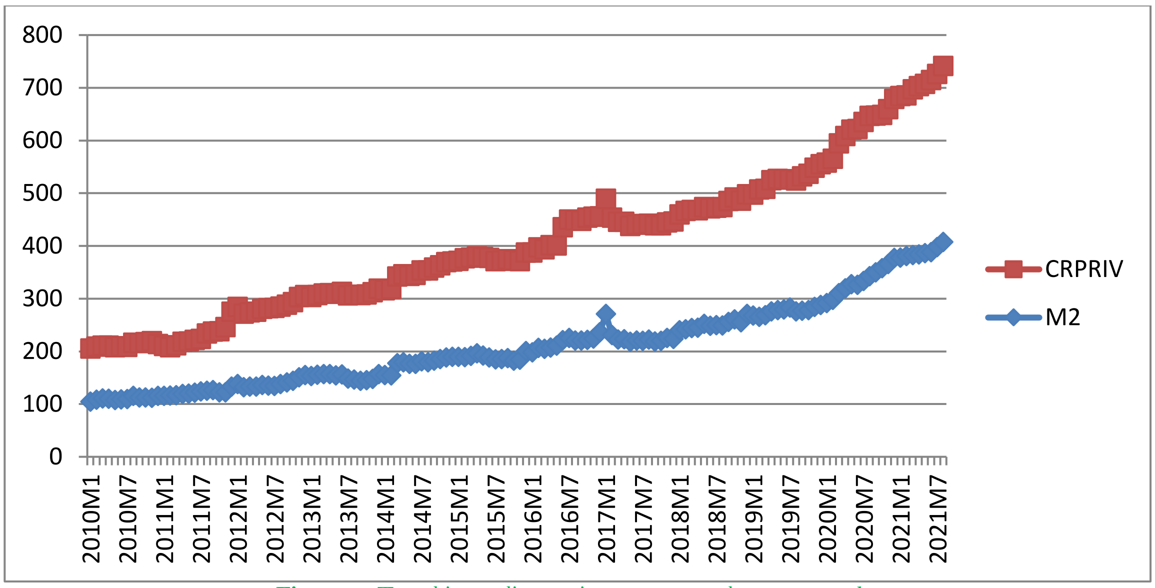

Figure 4. Trend in credit to private sector and money supply.

Note: CRPRIV = Credit to the Private Sector.
M2 = Broad Money Supply.
All variables are measured in billions of Naira.

Figure 5 shows the link between foreign interest rate (proxied by the US funds rate) and prime lending rate in Nigeria. The aim here is to tentatively check how deposit money banks react to changes in foreign interest rate. As profit-making entities, it is expected that each time foreign interest rate rises in relation to domestic interest rate, deposit money banks will channel their investments to foreign-currency-dominated investment outlets. The reverse is the case if foreign interest rate falls in relation to domestic interest rate. Such investment decisions have the tendency to influence the flow of domestic credit provision. As shown in Figure 5, in 2009 when the federal fund rate was flat, the prime lending rate was relatively high, and beginning from 2017 when the fund rate was experiencing a rising trend, the prime lending rate was flat.

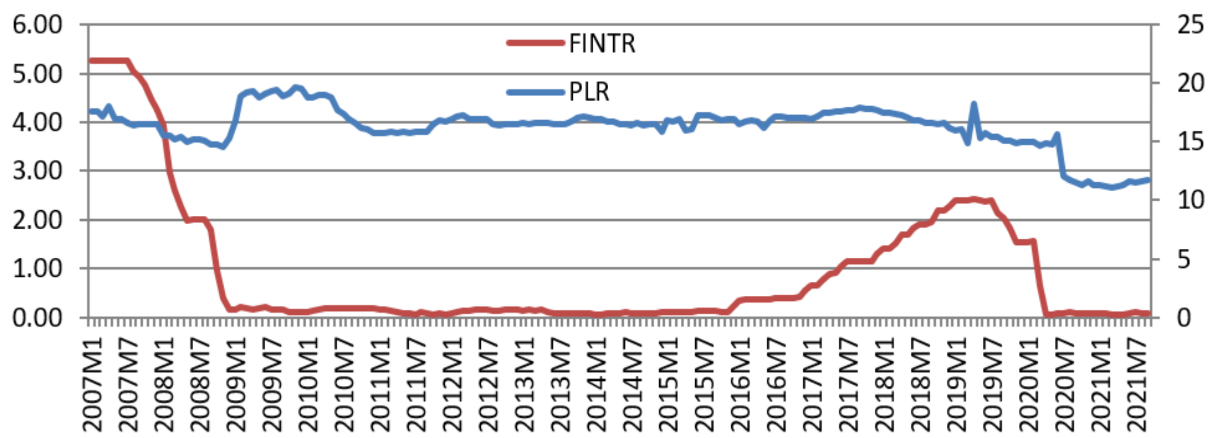

Figure 5. Trend in prime lending rate and foreign interest rate.

Note: FINTR = Foreign interest rate; PLR = Prime lending rate.

2. Theoretical Background

The theoretical basis for this study relies on the theoretical views of John Maynard Keynes, which are contained in his famous work The General Theory of Employment, Interest and Money" published in 1936. The role of government in economic intervention is recognized by Keynes as government is thought to stabilize the economy during the adverse phases of the business cycle and maintain full employment using fiscal policy measures. Keynes advocated the use of monetary mechanisms to influence aggregate demand, even though he contended that the role of money in achieving this is not a direct one. Keynes' views on both fiscal and monetary policies presuppose a blend of both measures because, in some instances, monetary policy could fail to achieve its objective. Following on Keynes' argument, Amacher & Ulbrich (1986) observed that monetary policy transmits to the larger economy through its influence on interest rate and thereafter to investment decisions of financial institutions, such as banks and other economic agents, and finally to output and income through the multiplier process. Operationally, Keynes' hypothesis can be stated as follows: Suppose the economy is experiencing recession, and to reflate the economy, the monetary authorities thought it necessary to purchase government securities through the open market operation (OMO). Such action is expected to increase the reserve position of deposit money banks (DMBs) and with increased liquidity banks will have enough leverage to extend credit. An empirical study by Nzeh, Uzoechina, Eze, Imoagwu, & Ozoh (2022) has shown that an increase in bank reserves leads to improved credit to the private sector in Nigeria. Increased credit provision creates new demand deposits which lead to rising money supply. As money supply rises, interest rate is expected to fall, which, in turn, stimulates investment, leading to economic prosperity via the multiplier process. Algebraically, the above channel can be stated as follows:

$$\downarrow OMO \rightarrow \uparrow R \rightarrow \uparrow M^S \rightarrow \downarrow r \rightarrow \uparrow I \rightarrow \uparrow GNP$$

Where: OMO = open market operations, R = reserves of deposit money banks, M^S = money supply, r = rate of interest, I = investment, and GNP = gross national product.

2.1. Empirical Literature Review

The importance of credit provision to the economy has led to studies devoted to investigating the factors affecting it. Even though monetary policy is expected to influence credit provision in a certain direction, there is yet to be a consensus on the actual impact of the various monetary policy instruments on credit provision. In Mauritius, Preethee, Allybokus, Sookia, & Gujadhur (2010) used a vector autoregressive (VAR) model with quarterly data from 1985Q1 to 2006Q4 to show that monetary policy is effective in credit provision in the short-run. Matemilola, Bany-Ariffin, & Muhtar (2014) applied the momentum threshold autoregressive and asymmetric error correction models to reveal that bank lending rate adjusts to a decrease in the money market rate in South Africa. A study on Nigeria by Onoh & Nwachukwu (2017) used the ordinary least squares (OLS) techniques to show that, while the monetary policy rate (MPR), cash reserve requirement (CRR) and money supply have a positive link with loan extension, the liquidity ratio is negatively linked to it. Using descriptive and ex post facto research design, Ndubuaku, Ifeanyi, Nze, & Onyemere (2017) showed that MPR did not have a significant impact on loans and advances during the SAP era in Nigeria. However, the impact is noticeable during the post-SAP period. In another study on Nigeria, Afolabi *et al.* (2018) employed Toda and Yamamoto's Granger non-causality model to reveal that MPR proved to be a significant variable that causes bank loans and advances in Nigeria. However, CRR and other variables do not Granger-cause loan and advances. Fisera & Kotlebova (2019) used the dynamic ordinary least squares (DOLS) and fully modified ordinary least squares (FMOLS) models to reveal that unconventional policies did not lift bank lending in Slovakia and the Czech Republic in the post-crisis era. In a study involving developing countries, Abuka *et al.* (2019) showed that monetary contraction reduces bank credit supply, increasing loan application rejections and tightening loan volume and rates. In Nigeria, Bassey & Ekong (2019) used the VAR framework to reveal that MPR, money supply and CRR were very effective in improving the credit performance of commercial banks in Nigeria. Adediran *et al.* (2019) employed the ARDL framework with annual data covering the period from 1980 to 2015 to show that cash reserve requirement is significant in growing the Nigerian economy compared to the monetary policy rate. Using the FMOLS model with monthly data covering the period from 2007 to 2019, Ademokoya *et al.* (2020) found that money supply significantly and positively influences bank credit in Nigeria, while the liquidity ratio significantly but negatively influences bank credit in Nigeria. However, the MPR and maximum lending rate did not significantly affect bank credit. Aikman, Lehnert, Liang, & Modugno (2020) used threshold VARs to show that credit is an important conditioning variable for the effects of financial variables on macroeconomic performance in the US. In a study on Sierra Leone, Bangura, Ngombu, Pessima, & Kargbo (2021) employed the generalized method of moments (GMM) model to reveal that MPR significantly and negatively influences banks' loan supply. For Nigeria, Udoh *et al.* (2021) used a VAR framework and monthly data spanning 2008–2018 to show that a positive shock to monetary policy rate has no effect on bank lending to the private sector. Pham, Le, & Nguyen (2021) used different econometric techniques to show that an increase in the base rate is significantly associated with a contraction in bank liquidity creation in 23 Vietnamese commercial banks. Osakwe *et al.* (2022) used the OLS technique to reveal that total private sector credit has a significant relationship on monetary policy rate, liquidity ratio and cash reserve ratio.

3. Methodology

In this paper, monthly data covering the period from 2010M1 to 2021M8 was used to analyze the response of bank financial intermediation to shocks in monetary policy instruments in Nigeria. Apart from data on foreign interest rate that were sourced from the Federal Bank of St Louis, data on other variables were obtained from the Central Bank of Nigeria's Statistical Bulletin. Exchange rate is in nominal form, while M2, credit to the private sector and credit to the government are in log form. Because of the dynamic nature of the relationship among the variables, the VAR framework was used. The suitability of the VAR model for this topic is based on the fact that it enables us to treat all of the variables as endogenous such that it can handle any effect that variables have on each other. The VAR framework adopted is a departure from the studies that adopted the OLS, DOLS and FMOLS models (Ademokoya *et al.*, 2020; Fisera & Kotlebova, 2019; Onoh & Nwachukwu, 2017). Since monetary variables by their nature experience Feedback, models that rely on a one-way approach cannot produce optimal results because possible feedback is ignored. However, the VAR approach is supported by Allybokus, Sookia, & Gujadhur (2010); Bassey & Ekong (2019) and Udoh *et al.* (2021). To ensure that a spurious regression is not run, first, the stationarity of the series was tested. In doing this, the augmented Dickey–Fuller (ADF) and Phillips–Perron (PP frameworks were utilized. The order of integration of the series guided the choice of the VAR model. Having shown that the series are I(1), we tested for cointegrating relationships using the Johansen cointegration technique. The Johansen cointegration test showed that the series are not cointegrated, thus eliminating the need to investigate a long-run impact. This led to estimation of the short-run unrestricted VAR model. In selecting the lag order for the VAR eight lags were chosen in the unrestricted VAR model without imposing any restriction on the coefficients. The optimal lag for the study was then selected using the Hannan–Quinn (HQ) information criterion, following Rummel (2015), who noted that the Hannan–Quinn information criterion is typically more appropriate for quarterly and monthly data. Thus, for optimal lag order selection, lag 1 is suggested by this criterion. The stability of the VAR model was tested using the inverse roots of the autoregressive characteristic polynomial. For the identification of the relationships existing among the variables, the Cholesky impulse response function in addition to the variance decomposition of the residuals are used in the study.

3.1. Basic VAR Model

Vector autoregression (VAR) is a framework applied to capture multivariate relationships in a model as the variables change over time. It is a type of stochastic process model in which each of the variables has an equation that models its evolution over time. The equation of each variable includes the lagged or past values of a particular variable as well as other variables' lagged values in addition to the innovation (error term). The evolution of the endogenous variables, known as a set of k variables over time, is described by the VAR model. Under this model, $t = 1....T$ is used to number each time period. A vector, x_t of length k, is modeled as a linear function of its lagged value. The order of VAR is very important and this order refers to the number of earlier periods to be included in the model. For instance, a p^{th} order VAR denotes a VAR model that includes last p time periods of lags. A typical p^{th} order VAR model can be represented in Equation 1 as:

$$x_t = c + A_1x_{t-1} + A_2x_{t-2} + \dots\dots\dots A_px_{t-p} + e_t \qquad (1)$$

Where:

x_{t-1} = lag of x_t.

c = k-vector of constant intercepts.

A_t = (k × k) - matrix that are time invariant.

e_t = *k*-vector of error terms.

The error terms or innovation must fulfill the following conditions: (i) $E(e_t) = 0$ which implies that the error terms have a mean of zero; (ii) $E(e_te_t^1) = \Omega$ (the covariance_matrix of innovations is a kxk positive semi-definite matrix denoted as Ω); (iii) $E(e_te_{t-k}) = 0$ (for every non-zero *k*, there is an absence of serial correlation across time).

In a VAR framework, it should be noted that all the variables in the model have to be integrated of the same order. If cointegration exists among the variables, the VAR model must contain an error correction term, and should such a condition occur, the model turns to a vector error correction model (VECM), which can be seen as a restricted VAR. In the absence of cointegration, a short-run unrestricted VAR is used to estimate short-run impacts. A two-variable VAR(1) is expressed in matrix form in Equation 2 as follows:

$$\begin{bmatrix} x_{1,t} \\ x_{2,t} \end{bmatrix} = \begin{bmatrix} c_1 \\ c_2 \end{bmatrix} + \begin{bmatrix} a_{1,1} & a_{1,2} \\ a_{2,1} & a_{2,2} \end{bmatrix} \begin{bmatrix} x_{1,t-1} \\ x_{2,t-1} \end{bmatrix} + \begin{bmatrix} e_{1,t} \\ e_{2,t} \end{bmatrix} \qquad (2)$$

Where

c_1, c_2 are the constant terms.

a^s are the kxk matrices.

e_1, e_2 are the error terms.

The scalar representation of Equation 2 can be stated in Equations 3 and 4 as follows:

$$x_{1,t} = c_1 + a_{1,1}x_{1,t-1} + a_{1,2}x_{2,t-1} + e_{1,t} \qquad (3)$$

$$x_{2,t} = c_2 + a_{1,1}x_{1,t-1} + a_{2,2}x_{2,t-1} + e_{2,t} \qquad (4)$$

In a more concise form, the general structure of the VAR model used for multivariate time series can be represented in Equation 5 as follows:

$$X_t = A_i + \sum_{t==1}^{k} \beta_i X_{t-1} + \varepsilon_t \qquad (5)$$

Where X_t = $Kx1$ vector of endogenous variables, A_i = vector of fixed intercept terms, ε_t = white noise with $\varepsilon_t \approx IID(O, \sigma^2)$, and K = lag order.

In this study, a seven-variable VAR model was run consisting of credit to the private sector, credit to the government, monetary policy rate, cash reserve requirement, exchange rate, money supply and foreign interest rate. The policy variables used in the study are monetary policy rate (MPR), cash reserve requirement (CRR) and money supply, which is an intermediate target. While the MPR is a benchmark rate that the CBN influences in order to influence other rates in the economy, the cash reserve ratio is influenced in order to directly influence the reserve position of deposit money banks (DMBs). We decomposed financial intermediation into credit to the private sector and credit to the public sector. As noted by Kim & Roubini (2000), exchange rate is a forward-looking asset price and, as such, can be treated as an exogenous variable in the model because the Nigerian economy is an open economy. Also, exchange rate stability is a major monetary policy objective in Nigeria. Foreign interest rate proxy by the US federal funds rate serves as another exogenous variable whose shock can be transmitted to the domestic economy. In matrix form, reflecting the variables used in this study, the VAR framework adopted is expressed in Equation 6 as follows:

$$\begin{bmatrix} LCRPRIV_t \\ LCRGOV_t \\ MPR_t \\ CRR_t \\ LM2_t \\ FINTR_t \\ EXCHR_t \end{bmatrix} = \begin{bmatrix} A_1 \\ A_2 \\ A_3 \\ A_4 \\ A_5 \\ A_6 \\ A_7 \end{bmatrix} + \begin{bmatrix} \beta_{1,1} & \beta_{1,2} & \beta_{1,3} & \beta_{1,4} & \beta_{1,5} & \beta_{1,6} & \beta_{1,7} \\ \beta_{2,1} & \beta_{2,2} & \beta_{2,3} & \beta_{2,4} & \beta_{2,5} & \beta_{2,6} & \beta_{2,7} \\ \beta_{3,1} & \beta_{3,2} & \beta_{3,3} & \beta_{3,4} & \beta_{3,5} & \beta_{3,6} & \beta_{3,7} \\ \beta_{4,1} & \beta_{4,2} & \beta_{4,3} & \beta_{4,4} & \beta_{4,5} & \beta_{4,6} & \beta_{4,7} \\ \beta_{5,1} & \beta_{5,2} & \beta_{5,3} & \beta_{5,4} & \beta_{5,5} & \beta_{5,6} & \beta_{5,7} \\ \beta_{6,1} & \beta_{6,2} & \beta_{6,3} & \beta_{6,4} & \beta_{6,5} & \beta_{6,6} & \beta_{6,7} \\ \beta_{7,1} & \beta_{7,2} & \beta_{7,3} & \beta_{7,4} & \beta_{7,5} & \beta_{7,6} & \beta_{7,7} \end{bmatrix} \begin{bmatrix} LCRPRIV_{t-1} \\ LCRGOV_{t-1} \\ MPR_{t-1} \\ CRR_{t-1} \\ LM2_{t-1} \\ FINTR_{t-1} \\ EXCHR_{t-1} \end{bmatrix} + \begin{bmatrix} \varepsilon^{LCRPRIV_t} \\ \varepsilon^{LCRGOV_t} \\ \varepsilon^{MPR_T} \\ \varepsilon^{CRR_t} \\ \varepsilon^{LM2_t} \\ \varepsilon^{FINTR_t} \\ \varepsilon^{EXCHR_t} \end{bmatrix} \qquad (6)$$

Where

$LCRPRIV$ = log of credit to the private sector, $LCRGOV$ = log of credit to the government, MPR = monetary policy rate, CRR = cash reserve requirement, LM2 = log of broad money supply (a proxy for money supply), $FINTR$ = foreign interest rate, and $EXCHR$ = exchange rate. The intercept terms are indicated by the A terms, the regression coefficients are indicated by the β values, and the error term of each equation at time t is indicated by the ε terms.

3.2. Lag Order Selection

Lag length selection is a special feature in the VAR model. The model selection criterion enables us to determine the lag length. As a rule, in the approach to fitting VAR (p) models, one has to first specify a VAR with orders p = 0, ..., $p_{\max}$ and thereafter to choose the value of p that minimizes some model selection criteria. For a VAR (p) model, the selection criteria can be in the form of Equation 7 below:

$$IC(p) = ln\left|\bar{\sum}(p)\right| + c_T * \varphi(n,p) \quad (7)$$

Where:

$IC(p)$ denotes information criterion with order p.

$\bar{\sum}(p) = T^{-1}\sum_{e-1}^{T}\hat{e}_t\,\hat{e}_t^{1}$ is the residual covariance matrix.

c_T is a sequence indexed by T (the sample size).

$\phi(n,p)$ is a function that denotes a penalty arising from large VAR(p) models.

The Akaike (AIC), the Bayesian (or Schwarz) (BIC/SIC) and Hannan–Quinn (HQC) are the three commonly used information criteria. These information criteria can be expressed as follows in Equations 8, 9 and 10:

$$AIC(p) = \ln\left|\bar{\sum}\mu(p)\right| + \frac{2}{T}pn^2 \quad (8)$$

$$BIC(p) = \ln\left|\bar{\sum}\mu(p)\right| + \frac{\ln T}{T}pn^2 \quad (9)$$

$$HQ = \ln\left|\bar{\sum}\mu(p)\right| + \frac{2\ln\ln T}{T}pn^2. \quad (10)$$

Where:

T = the effective sample size.

$\bar{\sum}\mu$ = the maximum likelihood estimate of $\bar{\sum}\mu$.

The lag order p is chosen in each case to minimize the value of the criterion over a range of alternative lag orders p, given by: $(\ p: 1 \le p \le \bar{p}\ )$.

Among these criteria, Kilian (2001) noted that the Schwarz information criterion (SIC) and the Hannan–Quinn information criterion (HQC) are believed to be better suited when analyzing finite lag order VAR models, while the Akaike information criterion (AIC) is more appropriate for infinite order autoregressions. Furthermore, the study observed, that of all the criteria, only the SIC and HQC are strongly consistent for p_0.

3.3. Impulse Responses

In order to analyze the dynamic behavior of financial intermediation proxy variables in the model owing to unanticipated shocks in the policy variables, the impulse response function is utilized. The impulse response function indicates the evolution of a variable over a period of time that is caused by a shock in another variable. It is the responses of all the variables in the model to a one-unit structural shock to one variable in the model and is plotted on the Y-axis with the periods from the initial shock on the X-axis. The impulse response variable investigates the effect of a shock e_t to the variable $x_{t,t+k}$. Enders (1995), as cited in Gan, Lee, Yong, & Zhang (2006), noted that each $\psi_{jk}(i)$ is interpreted as the time-specific partial derivatives of the VAR moving average (VMA) (∞) function. This is expressed in Equation 11 as follows:

$$\psi_{jk}(i) = \frac{\partial x_{ji}}{\partial e_k} \quad (11)$$

Equation 11 measures the change in the j^{th} variable in period t arising from a unit shock to the k^{th} variable in the current period.

3.4. Variance Decomposition

The variance decomposition of the innovations shows the part of information contributed by each variable as an explanation of the evolution of other variables. In their study, Allybokus et al. (2010) observed that to analyze the contribution of the error terms ε_t to the total forecast error variance (FEV), the system orthogonalized. Accordingly, if $E[\varepsilon_t\varepsilon'_t] = \Sigma$ and $R\Sigma R' = 1$, where R is lower triangular, then $E[R\varepsilon, \varepsilon', R'] = E[\lambda_t\lambda_t'] = 1$ where λ_t are the orthogonalized white noise innovations. Applying the moving average (MA) form of the VAR process, $x_{t+k} = \sum_{j=0}^{\infty}\varphi_j\varepsilon_{t+k-j}$, the optimal k-step forecast error is stated in Equation 12 as follows:

$$x_{t+k} - \hat{x}_{t+1} = \sum_{j=0}^{k=1} \varphi_l \varepsilon_{t+k-j} = \sum_{j=0}^{k-1} \varphi_j R^{-1} R \varepsilon_{t+k-j} = \sum_{j=0}^{k-1} C_j \lambda_{t+k-j} \quad (12)$$

4. Results Presentation and Discussion of Findings

This sub-section presents and interprets the results of the findings according to the processes followed in order to achieve the study's objective.

4.1. Stationarity Results

In every time series analysis, testing the order of integration of the series is essential to avoid generating results that are not relevant. In testing the stationarity of the series, this paper adopts the frameworks of the augmented Dickey–Fuller test (ADF) and the Phillips–Perron test (PP), which are conducted at the 5% level of significance. As shown in Table 1, the unit root results at level indicates that none of the series are stationary at the 5% level of significance apart from credit to the government under the PP. These results indicate that we cannot proceed with the analysis as any results generated based on these will be spurious. We therefore tested the unit root further by differencing the series by one period. The unit root results at first difference (see Table 2) show that the series become integrated of order one I(1) after first differencing.

Table 1. Result of the unit root tests at level.

Variables	ADF t-Stat.	PP t-Stat.	ADF Critical Value at 5%	PP Critical Value at 5%	Order of Integration
LCRPRIV	-2.42	-2.26	-3.44	-3.44	-
LCRGOV	-2.81	-4.84*	-3.44	3.44	PP I(0)
MPR	-1.42	-1.50	-3.44	-3.44	-
CRR	-1.98	-2.74	-3.44	-3.44	-
LM2	-0.61	-0.18	-3.44	-3.44	-
FINTR	-1.20	-1.20	-3.44	-3.44	-
EXCHR	-2.64	-2.17	-3.44	-3.44	-

Note: Figures with asterisks (*) indicate rejection of the null hypothesis at the 5% level.

Table 2. Results of the unit root tests at first difference.

Variables	ADF t-stat.	PP t-stat.	ADF Critical Value at 5%	PP Critical Value at 5%	Order of Integration
Δ LCRPRIV	-9.23*	-9.23*	-3.44	-3.44	I(1)
Δ LCRGOV	-16.5*	-16.6*	-3.44	-3.44	I(1)
Δ MPR	-11.5*	-11.5*	-3.44	-3.44	I(1)
Δ CRR	-8.53*	-11.8*	-3.44	-3.44	I(1)
Δ LM2	-12.10*	-13.2*	-3.44	-3.44	I(1)
Δ FINTR	-7.33*	-7.26*	-3.44	-3.44	I(1)
Δ EXCHR	-5.70*	-6.50*	-3.44	-3.44	I(1)

Note: Figures with asterisks (*) indicate rejection of the null hypothesis at the 5% level.

4.2. Lag Selection Criteria

With the stationarity results showing that the series are I(1), it is proper to investigate the cointegrating relationship among the variables using the Johansen cointegration technique. However, the lag order selection is a prerequisite for testing for cointegration. For lag order selection, eight lags were chosen in the unrestricted VAR model without imposing any restriction on the coefficients. In Table 3, each selection criterion shows the optimal number of lags. The Hannan–Quinn information criterion was chosen to obtain the optimal lag for this study. Table 3 shows that lag 1 is selected by both the HQC and SIC

4.3. Lag Exclusion

To further test the reliability of the chosen optimal lag, a lag exclusion test was conducted. This test is guided by the statistical significance of the P-value of the joint model variables. If the p-value is less than 0.05, we can conclude that the chosen lag is appropriate. Table 4 shows the Wald test results of the VAR lag exclusion. The test shows that the joint p-value is statistically significant at the 5% significance level. On account of this, the lag order selected by the Hannan–Quinn information criterion is appropriate for the study.

Table 3. VAR lag order selection criteria.

Lag	Log L	LR	FPE	AIC	SIC	HQC
0	-1227.7	NA	0.56	19.3	19.4	19.4
1	-115.6	2085.2	3.45	2.68	3.93*	3.19*
2	-50.3	115.3	2.69	2.43	4.77	3.38
3	6.29	93.8	2.43*	2.31*	5.74	3.70
4	41.9	55.07	3.09	2.52	7.04	4.36
5	79.9	54.7	3.87	2.69	8.30	4.97
6	134.5	72.5*	3.85	2.60	9.31	5.33
7	183.9	60.2	4.30	2.59	10.4	5.76
8	228.7	49.8	5.39	2.66	11.6	6.27

Note: * indicates lag order selected by the chosen criterion.
LR= likelihood ratio, FPE = final prediction error; AIC:= Akaike information criterion, SIC = Schwarz information criterion, HQC = Hannan–Quinn information criterion.

Table 4. VAR lag exclusion Wald tests.

Chi-squared test statistics for lag exclusion numbers in [ ] are p-values								
Variables	**LCRPRIV**	**LCRGOV**	**MPR**	**CRR**	**LM2**	**EXCHR**	**FINTR**	**Joint**
Lag 1	166.03 [0.00]	29.7 [0.00]	142.6 [0.00]	99.6 [0.00]	92.2 [0.00]	356.2 [0.00]	284.9 [0.00]	1117.7 [0.00]
Lag 2	12.4 [0.09]	18.9 [0.008]	22.1 [0.002]	5.98 [0.54]	3.37 [0.85]	50.3 [1.24]	29.9 [9.82]	138.5 [1.77]
Df	7	7	7	7	7	7	7	7

4.4. Inverse Roots of the AR Result

The stability of the VAR model is essential for the reliability of the results. When a VAR model is stable, the implication is that any shocks in the system are temporary and will disappear after a period of time. In testing for VAR stability, the inverse roots of the autoregressive characteristic polynomial were employed. Birman (2012) noted that in an autoregressive process, AR(1): $y_t = \alpha_o + \alpha_1 y_{t-1} + \varepsilon_t$, the prerequisite for stability is $\lfloor \alpha_1 \rfloor \prec 1$. However, in a VAR system denoted as $x_t = A_0 + A_1 x_{t-1} + \varepsilon_t$, the condition for stability is that the roots of the characteristic equation of the matrix should lie inside the unit circle. The result of the inverse roots of the autoregressive characteristic polynomial, as shown in Figure 6, indicates that the AR process is stationary since the roots of the equation are found within the unit circle.

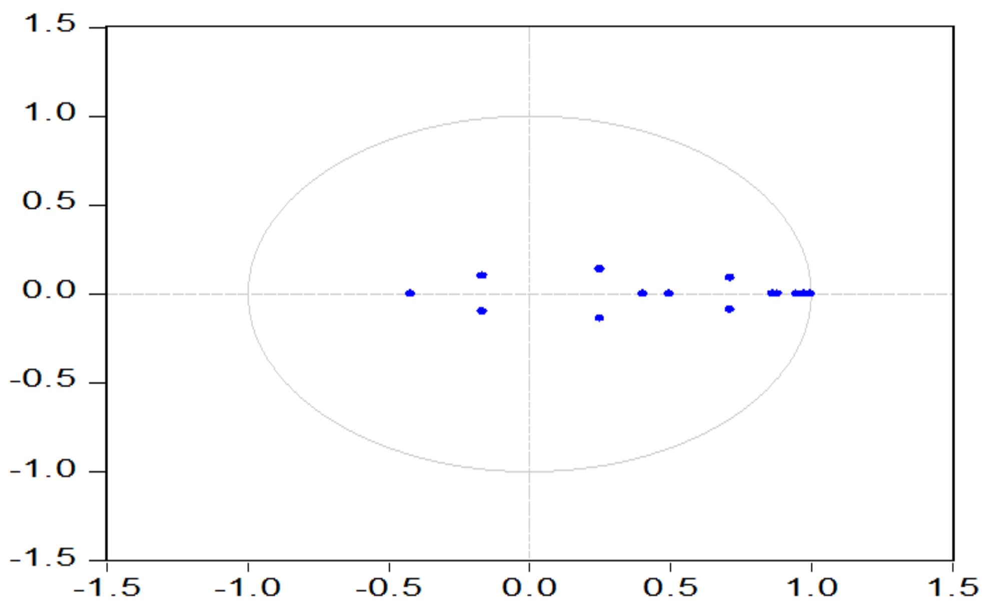

Figure 6. Inverse roots of the autoregressive characteristic polynomial.

4.5. Cointegration Results

As noted earlier, the Johansen cointegration test was used to investigate the long-run equilibrium relationship among the model variables since the series are integrated of order one, i.e., I(1). Tables 5 and 6 display the results of the cointegration tests with both the trace and maximum eigenvalue tests indicating p-values that are greater than the 5% level of significance at all the levels. The results of these tests confirm that the series are not cointegrated. The implication of the non-existence of a long-run relationship among the series is that we cannot investigate the long-run impacts, thus we only have to consider a short-run relationship among the series.

Table 5. Unrestricted cointegration rank test (trace).

Hypothesized No. of CE(s)	Eigenvalue	Trace Statistic	0.05 Critical Value	Prob.
None	0.23	105.9	125.6*	0.42
At most 1	0.17	71.8	95.8*	0.66
At most 2	0.15	47.1	69.8*	0.76
At most 3	0.10	25.2	47.9*	0.91
At most 4	0.05	10.3	29.8*	0.98
At most 5	0.02	3.28	15.5*	0.95
At most 6	0.004	0.56	3.84*	0.46

Note: Trace test indicates no cointegration at the 0.05 level.
* Denotes rejection of the hypothesis at the 0.05 level.

Table 6. Unrestricted cointegration rank test (maximum eigenvalue).

Hypothesized No. of CE(s)	Eigenvalue	Max. Eigen Statistic	0.05 Critical Value	Prob.
None	0.23	34.1	46.2*	0.52
At most 1	0.17	24.7	40.07*	0.79
At most 2	0.15	21.9	33.9*	0.6157
At most 3	0.11	14.9	27.6*	0.75
At most 4	0.05	6.99	21.1*	0.95
At most 5	0.02	2.72	14.3*	0.96
At most 6	0.004	0.56	3.84*	0.45

Note: Maximum eigenvalue test indicates no cointegration at the 0.05 level.
* Denotes rejection of the hypothesis at the 0.05 level.

4.6. Impulse Response Results

The impulse response results in Appendix 1 indicate that credit to the private sector responds positively to money supply in all the periods under study. This is in accord with *a priori* expectation as rising money supply without regulation increases liquidity in the banking system, which gives deposit money banks enough leverage to extend credit facilities. The macroeconomic implications of rising money supply, especially its impact on the price level, is among the major rationales for monetary policy intervention. In Nigeria, the main policy thrust of the monetary authority is inflation targeting, bearing in mind that growing monetary aggregates cause inflation. The findings also show that credit to the private sector responds positively to monetary policy rate (MPR) in all the periods. However, this result is not supported by Udoh et al. (2021), who found no significant link between credit to the private sector and shocks to the MPR. This finding is contrary to the objective of monetary policy as a tool to reduce the ability of banks to extend credit using contractionary monetary policy, such as increase in the MPR. As the MPR is a benchmark rate that influences other rates, we are of the view that banks take advantage of the rising interest rate occasioned by a high MPR to extend more credit to the private sector since they are profit-oriented. This explains why the lending rate in Nigeria is always very high compared to the deposit rate.

It was also found that credit to the private sector responded positively to the cash reserve ratio (CRR) up to the fourth period, but from period five the response became negative. As a tool to reduce the ability of banks to extend credit through influencing their reserve position, especially during inflationary periods, the CBN alters the cash reserve ratio in most of its monetary policy committee meetings to align with current macroeconomic reality. The fact that the actual impact of the policy is felt after the fourth period is an indication of the time the policy takes to influence the targeted objective. Credit to the private sector was found to negatively respond to foreign interest rate starting from period two. As an exogenous variable, shocks to foreign interest rate reverberate to the domestic economy. A rise in US funds rate, for instance, provides an investment opportunity for deposit money banks such that it dampens their domestic financial intermediation role as they scramble to avail of the opportunity to invest in foreign denominated assets. Credit to the private sector was found to respond negatively to the exchange rate from period two and thereafter. This shows the sensitivity of exchange rate to credit provision in Nigeria as banks consider foreign currency denominated investment assets as alternatives to domestic credit extension.

In another vein, credit to the government responded positively to money supply up to the second period, but thereafter the response became negative. We contend that a rising money supply reduces the need for the government to borrow money, and the falling interest rate this scenario entails provides additional rationale for reduced bank lending. Findings also show that credit to the government responded negatively to the MPR starting from period three. This is contrary to the response of credit to the private sector to shocks in the MPR, which is positive throughout the whole period. Since credit to the government is mainly in the form of bonds with a fixed interest rate, as the MPR is raised we contend that banks would prefer to lend to the private sector with a market-determined interest rate to generate more revenue. Unlike the response of credit to the private sector to changes in the cash reserve requirement, credit to the government responds positively to the cash reserve requirement in all periods. The implication is that banks become risk averse when their reserves are reduced and would prefer to lend more to the government since public sector credit is more secure. In all the periods, results show that credit to the government responds positively to the foreign interest rate and the exchange rate. As an intermediate target that can be influenced to impact key monetary policy objectives, money supply was found to respond negatively to both the MPR and the CRR after the first and second periods. Rising money supply entails increases in policy instruments in order to neutralize the impact of monetary growth on the macroeconomic variables, especially price level. The findings reveal how shocks to foreign interest rate transmit to money supply in Nigeria as money supply responds negatively to foreign interest rate after the first period. A rise in foreign interest rate in relation to domestic interest rate means that domestic interest rate bearing investment assets are becoming less attractive and the consequence is rising capital outflows and lower capital inflows, hence the reduction in money supply.

4.7. Variance Decomposition Results

The results of the variance decomposition in Appendix 2 that other than shocks to itself, which was 100% in the first period, shocks to money supply explained about 0.81% of shocks to credit to the private sector in the second period, which continuously rise until it settled at 36% in the last period. Shocks to the MPR explained about 1.4%, 2.8% and 3.9% in periods two, three and four, respectively, to shocks to credit to the private sector until it settled at 4% from period five until the last period. Shocks to the CRR explained about 0.4% of shocks to credit to the private sector, which marginally rose until it settled at approximately 3% in the last period. Foreign interest rate shocks explained about 0.2% of shocks to credit to the private sector and these shocks fluctuated over the period. Findings also reveal that other than shocks to itself, which was 99.89% in the first period, shocks to money supply explained about 0.58% of shocks to credit to the government in the second period, which fell to 0.47% in the third period, and then the shocks marginally reduced up until the last period. Shocks to the MPR explained about 0.03% of shocks to credit to the government in the second period, which marginally rose to 0.05% in the third period, reduced to 0.047% in the fifth period, and finally settled at 0.14% in the last period. Shocks to the CRR explained about 0.96% of shocks to credit to the government in the second period, which increased thereafter until it settled at 3.6% in the last period. Shocks to foreign interest rate explained about 1.16% of shocks to credit to the government in the second period, which marginally fluctuated until it settled at 2.1% in the last period.

5. Conclusion and Recommendations

In this study, we set out to investigate the responses of credit to the private sector and credit to the government to shocks in monetary policy instruments using the VAR model with monthly data covering the period from 2010M1 to 2021M8. The findings reveal that credit to the private sector and credit to the government respond differently to shocks in monetary policy instruments. For instance, while credit to the government responded negatively to shocks in the MPR after couple of periods, the response of credit to the private sector to shocks in the MPR was positive through the entire period under study. Also, as credit to the private sector responded negatively to shocks in the cash reserve requirement, the response of credit to the government was positive throughout the whole period. We found that money supply responded negatively to shocks in the MPR and CRR after a short period of time and also responded negatively to shocks in foreign interest rate. The conclusion of our findings is that different monetary policy tools exert different influences on both credit to the private sector and credit to the government. The policy implications of these findings are that, for a government that wants to improve private sector lending in order to improve productivity and reduce unemployment, it would not be appropriate to use uniform monetary policy tools to influence the direction of credit. The use of selective credit, though not commonly used, should be given priority to ensure that credit flows to the chosen sector. Thus, for the monetary authorities to envisage that uniform monetary policy tools could influence the flow of credit to the two sectors of the economy in a similar direction could be misleading. Second, even though both the CRR and MPR work effectively in influencing money supply, which is used as an intermediate target, the inability to factor in the influence of foreign interest rate shock could work against the use of these tools to influence money supply. A rise in foreign interest rate, for instance, could lead to an abrupt capital outflow, which will reduce money supply and thus jeopardize the expansionary monetary stance of the monetary authorities and vice versa. Consequently, we recommend that policy tools used to influence financial intermediation should factor in the sensitivity of both public and private sectors to changes in these tools. Also, the use of both the MPR and CRR to influence money supply should be given priority, especially during intense deflationary or inflationary periods, while monetary authorities should be conscious of the effects of exogenous shocks on domestic money supply.

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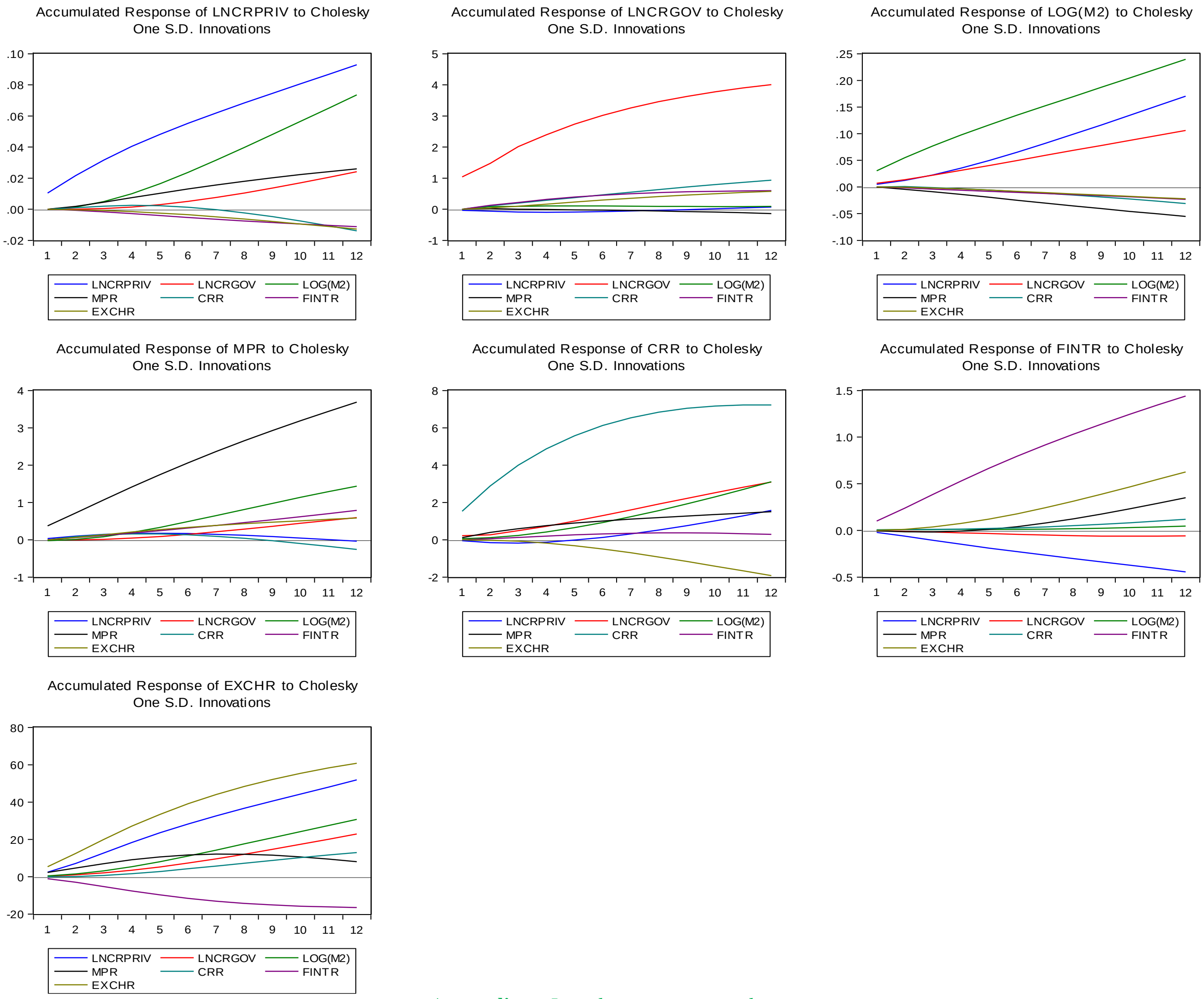

Appendix 1. Impulse response results.

Appendix 2. Variance decomposition results.

Variance decomposition of LCRPRIV.

Period	S.E.	LCRPRIV	LCRGOV	L(M2)	MPR	CRR	FINTR	EXCHR
1	0.01	100.0	0.00	0.00	0.00	0.00	0.00	0.00
2	0.02	97.2	0.002	0.81	1.37	0.39	0.21	0.06
3	0.02	92.2	0.04	3.84	2.84	0.57	0.42	0.11
4	0.02	86.04	0.22	8.53	3.94	0.48	0.59	0.18
5	0.02	79.5	0.57	13.9	4.60	0.39	0.73	0.28
6	0.03	73.3	1.08	19.03	4.91	0.46	0.81	0.41
7	0.03	67.7	1.68	23.5	4.98	0.69	0.85	0.55
8	0.03	62.9	2.32	27.3	4.90	1.04	0.86	0.69
9	0.03	58.8	2.96	30.4	4.75	1.47	0.85	0.83
10	0.04	55.4	3.56	32.8	4.57	1.94	0.83	0.95
11	0.04	52.51	4.12	34.7	4.38	2.42	0.80	1.05
12	0.04	50.1	4.63	36.3	4.19	2.89	0.77	1.13

Note: Cholesky Ordering: LCRPRIV, LCRGOV, L(M2), MPR, CRR, FINTR, EXCHR.

Variance decomposition of LCRGOV.

Period	S.E.	LCRPRIV	LCRGOV	L(M2)	MPR	CRR	FINTR	EXCHR
1	1.04	0.10	99.9	0.00	0.00	0.00	0.00	0.00
2	1.145959	0.16	96.9	0.58	0.03	0.96	1.16	0.14
3	1.27	0.18	96.2	0.47	0.05	1.23	1.52	0.32
4	1.34	0.15	95.4	0.44	0.05	1.54	1.89	0.51
5	1.39	0.15	94.8	0.41	0.06	1.83	2.05	0.69
6	1.42	0.15	94.3	0.39	0.06	2.13	2.13	0.86
7	1.45	0.16	93.8	0.38	0.07	2.42	2.16	1.003
8	1.46	0.18	93.4	0.37	0.08	2.69	2.17	1.12
9	1.48	0.20	93.03	0.36	0.09	2.95	2.16	1.21
10	1.49	0.23	92.7	0.36	0.10	3.18	2.14	1.29
11	1.49	0.26	92.4	0.35	0.12	3.38	2.13	1.34
12	1.50	0.29	92.2	0.35	0.14	3.56	2.11	1.38

Note: Cholesky Ordering: LCRPRIV, LCRGOV, L(M2), MPR, CRR, FINTR, EXCHR.

Variance decomposition of L(M2).

Period	S.E.	LCRPRIV	LCRGOV	L(M2)	MPR	CRR	FINTR	EXCHR
1	0.03	2.66	4.89	92.4	0.00	0.00	0.00	0.00
2	0.04	4.60	5.35	88.8	1.09	0.03	0.14	0.006
3	0.05	7.52	6.81	83.5	1.59	0.15	0.33	0.09
4	0.06	11.03	7.89	78.2	2.09	0.26	0.40	0.18
5	0.06	14.5	8.71	73.2	2.47	0.39	0.44	0.27
6	0.07	17.7	9.30	69.004	2.76	0.51	0.46	0.35
7	0.07	20.4	9.72	65.5	2.92	0.63	0.47	0.41
8	0.08	22.8	10.008	62.5	3.02	0.75	0.48	0.44
9	0.08	24.8	10.2	60.1	3.08	0.86	0.49	0.48
10	0.09	26.6	10.4	58.03	3.09	0.97	0.51	0.50
11	0.09	28.02	10.4	56.3	3.09	1.07	0.53	0.52
12	0.09	29.3	10.5	54.9	3.07	1.18	0.55	0.56

Note: Cholesky Ordering: LCRPRIV, LCRGOV, L(M2), MPR, CRR, FINTR, EXCHR.

Variance decomposition of MPR.

Period	S.E.	LCRPRIV	LCRGOV	L(M2)	MPR	CRR	FINTR	EXCHR
1	0.38	0.74	0.03	0.52	98.7	0.00	0.00	0.00
2	0.53	1.84	0.03	0.69	92.4	2.66	1.03	1.32
3	0.65	1.69	0.04	1.75	90.5	2.30	1.56	2.11
4	0.75	1.39	0.22	3.53	88.6	1.81	1.89	2.53
5	0.84	1.12	0.46	5.54	86.7	1.45	2.12	2.65
6	0.92	0.95	0.78	7.45	84.6	1.29	2.33	2.63
7	0.99	0.86	1.13	9.14	82.5	1.28	2.53	2.54
8	1.05	0.84	1.48	10.6	80.5	1.39	2.75	2.44
9	1.10	0.85	1.81	11.7	78.7	1.60	2.98	2.34
10	1.16	0.88	2.12	12.6	77.09	1.86	3.21	2.25
11	1.20	0.93	2.39	13.3	75.6	2.14	3.45	2.18
12	1.24	0.98	2.62	13.8	74.4	2.42	3.69	2.12

Note: Cholesky Ordering: LCRPRIV, LCRGOV, L(M2), MPR, CRR, FINTR, EXCHR.

Variance decomposition of CRR.

Period	S.E.	LCRPRIV	LCRGOV	L(M2)	MPR	CRR	FINTR	EXCHR
1	1.55	0.11	1.97	0.09	0.54	97.3	0.00	0.00
2	2.08	0.32	1.14	0.14	2.06	96.3	0.06	0.02
3	2.38	0.25	1.75	0.36	2.27	95.2	0.13	0.06
4	2.57	0.25	2.31	0.84	2.38	93.8	0.20	0.19
5	2.69	0.39	3.20	1.50	2.40	91.8	0.24	0.45
6	2.79	0.64	4.09	2.37	2.41	89.4	0.26	0.82
7	2.87	1.01	5.02	3.39	2.39	86.6	0.26	1.29
8	2.94	1.48	5.89	4.53	2.38	83.6	0.25	1.83
9	3.004	2.03	6.68	5.77	2.35	80.5	0.26	2.39
10	3.07	2.65	7.37	7.04	2.32	77.4	0.23	2.94
11	3.13	3.30	7.97	8.34	2.28	74.4	0.23	3.48
12	3.19	3.99	8.44	9.63	2.24	71.5	0.24	3.97

Note: Cholesky Ordering: LCRPRIV, LCRGOV, L(M2), MPR, CRR, FINTR, EXCHR.

Variance decomposition of FINTR.

Period	S.E.	LCRPRIV	LCRGOV	L(M2)	MPR	CRR	FINTR	EXCHR
1	0.10	4.68	0.17	0.29	0.27	0.08	94.5	0.00
2	0.18	6.25	0.15	0.12	0.40	0.13	92.5	0.46
3	0.24	7.03	0.19	0.07	0.24	0.08	91.03	1.35
4	0.28	7.29	0.21	0.05	0.25	0.07	89.5	2.66
5	0.32	7.29	0.24	0.04	0.56	0.08	87.5	4.28
6	0.35	7.19	0.26	0.03	1.16	0.11	85.1	6.10
7	0.38	7.06	0.26	0.03	1.98	0.17	82.5	8.02
8	0.41	6.92	0.25	0.04	2.95	0.24	79.7	9.91
9	0.46	6.80	0.23	0.05	3.99	0.33	76.8	11.7
10	0.46	6.71	0.21	0.06	5.04	0.42	74.2	13.4
11	0.48	6.64	0.19	0.08	6.05	0.53	71.6	14.9
12	0.50	6.60	0.17	0.10	7.007	0.62	69.2	16.3

Note: Cholesky Ordering: LCRPRIV, LCRGOV, L(M2), MPR, CRR, FINTR, EXCHR.

Variance decomposition of EXCHR.

Period	S.E.	LCRPRIV	LCRGOV	L(M2)	MPR	CRR	FINTR	EXCHR
1	6.31	13.8	0.30	0.39	12.7	0.002	3.15	69.6
2	11.2	22.4	0.48	1.03	8.58	0.01	3.75	63.8
3	15.1	26.2	0.75	1.74	7.17	0.12	4.40	59.6
4	18.0	27.9	1.12	2.72	6.29	0.36	4.79	56.9
5	20.3	28.5	1.61	3.90	5.58	0.67	4.92	54.8
6	22.08	28.8	2.21	5.19	4.94	0.97	4.87	53.05
7	23.5	28.8	2.91	6.47	4.41	1.27	4.70	51.4
8	24.6	28.9	3.66	7.67	4.003	1.53	4.49	49.7
9	25.6	28.9	4.43	8.77	3.76	1.75	4.26	48.08
10	26.6	29.1	5.17	9.73	3.60	1.94	4.06	46.4
11	27.4	29.3	5.87	10.4	3.58	2.09	3.82	44.7
12	28.1	29.5	6.52	11.3	3.65	2.20	3.63	43.1

Note: Cholesky Ordering: LCRPRIV, LCRGOV, L(M2), MPR, CRR, FINTR, EXCHR.