The Relative Effectiveness of Monetary Policy on Investment in Nigeria

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Abstract

This study investigated the relative effectiveness of monetary policy on investment in Nigeria for the period 1990Q1 to 2019Q4 using SVAR model. The study found out that monetary policy is effective for influencing investment in Nigeria in short run, medium and long run. Specifically, the study found out that interest rate, bank credit and exchange rate are the most effective variables for influencing investment when compared with other variables (money supply, inflation and exchange rate) within the model of the study. The study therefore recommend that central bank should peg monetary policy rate at a threshold suitable to increase money supply and credit facilitation by commercial banks in order to stimulate investment in the Nigeria economy.

Key Words: *Relative Effectiveness, Monetary Policy, Investment*

1. Introduction

As every nation focus on achieving economic growth, various channels via which this desired goal can be achieved are pursued. This includes effective utilization of both monetary and fiscal policies. Monetary policies are policies geared toward influencing monetary variables such as money supply, monetary policy rate among others in order to attain economic growth. Fiscal policy on the other hand is the policy that involves the use of taxes and expenditure to influence economic activities (Omar & Nazatul, 2018). Economists and policy makers have been working on identifying the effects of these policies to stabilize the economy. The macro economic issues such as high unemployment, rising output of goods and services, and relatively stable prices are among others widely accepted as macroeconomic goals. Responsibility for economic stabilization and actions to meet these goals has been given to monetary and fiscal authorities. But their relative effectiveness and impacts on affecting output is a controversy that has created argument among economists and policy makers.

To this end, how these policies stance are derived to stimulate investment is of essence. Several studies have provided insight into the relationship between monetary as well as fiscal policy on output in Nigeria (Omar & Nazatul, 2018; Kutu & Ngalawa, 2016; Afrin, 2017). However, to the best of the researchers' knowledge, no work has been conducted to examine the effectiveness of monetary policy on investment in Nigeria, taking into cognizance, the interplay of the variables in this study. Even for the work of Obinna (2020) on monetary policy and investment, the choice of model (VECM) and period of study (1981-2018) calls for further investigation on the subject matter. Monetary innovations channel impulses to investment through broad money supply, interest rate, exchange rate, bank credit, and inflation, but the question that remains unanswered is how does investment respond to innovation change in monetary policy in Nigerian economy.

In this sense, simultaneity with respect to relative effectiveness of monetary policy and investment is necessary in their coefficients used for policy in Nigeria. Hence, this study examined the relative effectiveness of monetary policy on investment in Nigerian economy.

2. Literature Review

2.1 Theoretical Framework

This is situated on pure monetary business circle theory and Mckinnon/Shaw Theory. Hawtrey (1939) developed the theory of monetary business circle which takes into account an economy's money and credit system to analyze business circles. It states that successive rounds of inflation and deflation accelerated by changes in money flows are responsible for business circles. According to the theory, as the money supply increases, prices rise, profits increase, and investment is stimulated for further production. On the other hand, if there is a contraction of money supply, prices go down, profits go down, investment is adversely affected leading to declining manufacturing activities. Mckinnon (1973) and Shaw (1973) theory argue for financial liberalization and the need to ease financial repression (by removing credit control) as a way of stimulating investment vis-à-vis economic growth. According to them, financial liberalization will lead to economic growth by increasing private investment in critical sectors of the economy.

By linking these theories in line with this study, since supply of money increases price, profits and investment for further production, it goes to agree with liberalization view of Mckinnon and Shaw to emphasis that effective monetary policy regarding money supply, credit creation as well as lowering interest rates will go a long way to positively influence investment.

2.2 Empirical Reviews

Ndubuisi (2017) studied the dynamic relationship between fiscal policy and economic growth in Nigeria covered the period 1985-2015, the data were analyzed used OLS, unit root test, Error Correction mechanism and co-integration. The results revealed that fiscal policy significantly influenced growth in Nigeria economy. Assessing the effectiveness of fiscal policy on Jordan economy for the period 1990-2015, with the use of Structural Vector Autoregressive (SVAR) model, Sarangi et al., (2015) revealed that current expenditure, subsidies, social benefits and compensation to employees have positive impact. The study also showed that remittances are an effective factor in reducing poverty and inequality in Jordan.

In a related study, investigating how monetary policy influence investment and the interaction of inflation among the variables, Obinna (2020) found out that interest rate is an effective stabilizer of the economy and however that the effectiveness of this tool depends on the inflation rate in the economy as the effect of interest rate on investment gets weaker as general price rises in Nigeria.

Using a Structural Vector Autoregression model, Kutu and Ngalawa (2016) study how monetary shocks affect industrial output in BRICS countries. The results of the study provide evidence that an exchange rate shock (depreciation) has a relevant positive impact on industrial output over time. Furthermore, the variations in the money supply explain the variations of the exchange rate better than the variations in the interest rate. Therefore, the money supply exerts more influence on industrial output than the interest rates. In addition, Afrin (2017) explores the transmission mechanism of monetary policy in Bangladesh. The result suggests that money supply targeting plays an important role in influencing the price level while the role of bank credit is not meaningful. Using data for the period from 1970 to 2002, Eregha (2010) investigates the association between the interest rate and investment in Nigeria. The result shows that the interest rate is negatively correlated with investment. Tran et al. (2019) use data for 250 Vietnamese firms to study the impact of expansionary monetary policy on corporate investment. They find that an expansionary monetary policy increases firm borrowing and enhances corporate investment. In all, methodological differences, conceptual and spatial deficiency in these studies created gap for the present one.

3. Methodology

3.1 Data

Quarterly data spanning the period 1990Q1 to 2019Q4 were used for this study. All data were sourced from the CBN Statistical database. The variables for the study consist of money supply (M2), nominal exchange rate (EXR), INTR=Interest rate, Bank Credit (BC), IN=Investment and INF=Inflation. While M2, INTR and BC are monetary policy variables (MPV), INF and EXR are other variables that affect investment and as such are used as controlled variables. The data were transformed to natural logarithm in order to rule out the differences in the unit of estimation and yield robust estimation.

3.2 Vector Autoregressive (VAR) Versus Structural Vector Autoregressive (SVAR)

The vector autoregressive (VAR) model is a workhouse multivariate time series model that relates current observations of a variable with past observations of itself and past observations of other variables in the system. The Vector autoregressive (VAR) model also constitute a general approach to modeling multivariate time series. A major limitation of these models in their standard form is their missing ability to describe contemporaneous relationships between the analyzed variables. This becomes a central issue in the impulse response analysis for such models, where it is important to know the contemporaneous effects of a shock to the variable of concern. Usually, researchers address this by using orthogonal impulse responses, where the correlation between the errors is obtained from the (lower) Cholesky decomposition of the error covariance matrix (Manedo, 2022). This requires rearrangement of the variables of the model in a suitable order. Therefore, an alternative method to this approach is to use so-called structural vector autoregressive (SVAR) models, where the relationship between contemporaneous variables is demonstrated more directly. In other words, the use of SVAR to analyze monetary policy effects have been seen to produce relatively better and robust results despite the recent improvement in the use of VAR methodology. In addition, the SVAR is theoretically suitable and offers the benefit of identifying monetary policy as well as other shocks and or pass through effect among macroeconomic variables, hence, to analyze the spillover effect of monetary policy on consumption and investment.

Structural vector Autoregressive (SVAR) models include restrictions that allow us to identify causal relationships beyond those that can be identified with reduced form or recursive models. These causal relationships can be used to model and forecast impacts of individual shocks, such as policy decisions in our case the relative impacts of monetary policy shocks to target variable, consumption and investment. Moreover, the main aim of Structural Vector Autoregressive (SVAR) model analysis is not the parameter estimations but the dynamic response of impulse response and variance decomposition, because the estimated coefficient exhibits limited significance so the inference only rely on the dynamic interaction of the variables. This analysis of impulse response and variance decomposition is to analyze the effects of monetary policy on consumption and investment.

Specifying the model thus;

$$INV=f(M2, INTR, EXR, INF, BC) \quad (1)$$

Transposing the transmission yields

$$INV_t = f(INV_{t-1}, M2_{t-1}, INTR_{t-1}, EXR_{t-1}, INF_{t-1}, BC_{t-1}, M2_t, INTR_t, EXR_t, INF_t, BC_t) \quad (2)$$

$$M2_t= f(M2_{t-1}, INV_{t-1}, INTR_{t-1}, EXR_{t-1}, INF_{t-1}, BC_{t-1}, INV_t, INTR_t, EXR_t, INF_t, BC_t) \quad (3)$$

$$INTR_t = f(INTR_{t-1}, M2_{t-1}, INV_{t-1}, EXR_{t-1}, INF_{t-1}, BC_{t-1}, M2_t, INV_t, EXR_t, INF_t, BC_t) \quad (4)$$

$$EXR_t = f(EXR_{t-1}, M2_{t-1}, INV_{t-1}, INTR_{t-1}, INF_{t-1}, BC_{t-1}, M2_t, INV_t, INTR_t, INF_t, BC_t) \quad (5)$$

$$INF_t = f(INF_{t-1}, M2_{t-1}, INV_{t-1}, INTR_{t-1}, EXR_{t-1}, BC_{t-1}, M2_t, INV_t, INTR_t, EXR_t, BC_t) \quad (6)$$

$$BC_t = f(BC_{t-1}, M2_{t-1}, INV_{t-1}, INTR_{t-1}, EXR_{t-1}, INF_{t-1}, M2_t, INV_t, INTR_t, EXR_t, INF_t \quad (7)$$

Therefore, the normalized SVAR system of equation gives the following,

$$INV_t = \alpha^1{}_{11}INV_{t-1} + \alpha^1{}_{12}M2_{t-1} + \alpha^1{}_{13}INTR_{t-1} + \alpha^1{}_{14}EXR_{t-1} + \alpha^1{}_{15}INF_{t-1} + \alpha^1{}_{16}BC_{t-1} + \alpha^0{}_{12}M2_t + \alpha^0{}_{13}INTR_t + \alpha^0{}_{14}EXR_t + \alpha^0{}_{15}INF_t + \alpha^0{}_{16}BC_t + \varepsilon_{1t} \quad (8)$$

$$M2_t = \alpha^1{}_{21}INV_{t-1} + \alpha^1{}_{22}M2_{t-1} + \alpha^1{}_{23}INTR_{t-1} + \alpha^1{}_{24}EXR_{t-1} + \alpha^1{}_{25}INF_{t-1} + \alpha^1{}_{26}BC_{t-1} + \alpha^0{}_{21}INV_t + \alpha^0{}_{23}INTR_t + \alpha^0{}_{24}EXR_t + \alpha^0{}_{25}INF_t + \alpha^0{}_{26}BC_t + \varepsilon_{2t} \quad (9)$$

$$INTR_t = \alpha^1{}_{31}INV_{t-1} + \alpha^1{}_{32}M2_{t-1} + \alpha^1{}_{33}INTR_{t-1} + \alpha^1{}_{34}EXR_{t-1} + \alpha^1{}_{35}INF_{t-1} + \alpha^1{}_{36}BC_{t-1} + \alpha^0{}_{31}INV_t + \alpha^0{}_{32}M2_t + \alpha^0{}_{34}EXR_t + \alpha^0{}_{35}INF_t + \alpha^0{}_{36}BC_t + \varepsilon_{3t} \quad (10)$$

$$EXR_t = \alpha^1{}_{41}INV_{t-1} + \alpha^1{}_{42}M2_{t-1} + \alpha^1{}_{43}INTR_{t-1} + \alpha^1{}_{44}EXR_{t-1} + \alpha^1{}_{45}INF_{t-1} + \alpha^1{}_{46}BC_{t-1} + \alpha^0{}_{41}INV_t + \alpha^0{}_{42}M2_t + \alpha^0{}_{43}INTR_t + \alpha^0{}_{45}INF_t + \alpha^0{}_{46}BC_t + \varepsilon_{4t} \quad (11)$$

$$INF_t = \alpha^1{}_{51}INV_{t-1} + \alpha^1{}_{52}M2_{t-1} + \alpha^1{}_{53}INTR_{t-1} + \alpha^1{}_{54}EXR_{t-1} + \alpha^1{}_{55}INF_{t-1} + \alpha^1{}_{56}BC_{t-1} + \alpha^0{}_{51}INV_t + \alpha^0{}_{52}M2_t + \alpha^0{}_{53}INTR_t + \alpha^0{}_{54}EXR_t + \alpha^0{}_{56}BC_t + \varepsilon_{5t} \quad (12)$$

$BC_t = \alpha^1_{61}INV_{t-1} + \alpha^1_{62}M2_{t-1} + \alpha^1_{63}INTR_{t-1} + \alpha^1_{64}EXR_{t-1} + \alpha^1_{65}INF_{t-1} + \alpha^1_{66}BC_{t-1} + \alpha^0_{61}INV_t + \alpha^0_{62}M2_t + \alpha^0_{63}INTR_t + \alpha^0_{64}EXR_t + \alpha^0_{65}INF_t + BC_t + \varepsilon_{6t}$……………..…………………...(13)

Re-arranging the contemporaneous effects from the system of equation to the Left Hand Side (LHS) gives,

$INV_t - \alpha^0_{12}M2_t - \alpha^0_{13}INTR_t - \alpha^0_{14}EXR_t - \alpha^0_{15}INF_t - \alpha^0_{16}BC_t = \alpha^1_{11}INV_{t-1} + \alpha^1_{12}M2_{t-1} + \alpha^1_{13}INTR_{t-1} + \alpha^1_{14}EXR_{t-1} + \alpha^1_{15}INF_{t-1} + \alpha^1_{16}BC_{t-1} + \varepsilon_{1t}$ ……………………………………….…..(14)

$-\alpha^0_{21}INV_t + M2_t - \alpha^0_{23}INTR_t - \alpha^0_{24}EXR_t - \alpha^0_{25}INF_t - \alpha^0_{26}BC_t = \alpha^1_{21}INV_{t-1} + \alpha^1_{22}M2_{t-1}\ \alpha^1_{23}INTR_{t-1} + \alpha^1_{24}EXR_{t-1} + \alpha^1_{25}INF_{t-1} + \alpha^1_{26}BC_{t-1} + \varepsilon_{2t}$……………………………………………..(15)

$-\alpha^0_{31}INV_t - \alpha^0_{32}M2_t + INTR_t - \alpha^0_{34}EXR_t - \alpha^0_{35}INF_t - \alpha^0_{36}BC_t = \alpha^1_{31}INV_{t-1} + \alpha^1_{32}M2_{t-1} + \alpha^1_{33}INTR_{t-1} + \alpha^1_{34}EXR_{t-1} + \alpha^1_{35}INF_{t-1} + \alpha^1_{36}BC_{t-1} + \varepsilon_{3t}$……………………………………………(16)

$-\alpha^0_{41}INV_t - \alpha^0_{42}M2_t - \alpha^0_{43}INTR_t + EXR_t - \alpha^0_{45}INF_t - \alpha^0_{46}BC_t = \alpha^1_{41}INV_{t-1} + \alpha^1_{42}M2_{t-1} + \alpha^1_{43}INTR_{t-1} + \alpha^1_{44}EXR_{t-1} + \alpha^1_{45}INF_{t-1} + \alpha^1_{46}BC_{t-1} + \varepsilon_{4t}$……………………………………(17)

$-\alpha^0_{51}INV_t - \alpha^0_{52}M2_t - \alpha^0_{53}INTR_t - \alpha^0_{54}EXR_t + INF_t - \alpha^0_{56}BC_t = \alpha^1_{51}INV_{t-1} + \alpha^1_{52}M2_{t-1} + \alpha^1_{53}INTR_{t-1} + \alpha^1_{54}EXR_{t-1} + \alpha^1_{55}INF_{t-1} + \alpha^1_{56}BC_{t-1} + \varepsilon_{5t}$…………………………………………...(18)

$-\alpha^0_{61}INV_t - \alpha^0_{62}M2_t - \alpha^0_{63}INTR_t - \alpha^0_{64}EXR_t - \alpha^0_{65}INF_t + BC_t = \alpha^1_{61}INV_{t-1} + \alpha^1_{62}M2_{t-1} + \alpha^1_{63}INTR_{t-1} + \alpha^1_{64}EXR_{t-1} + \alpha^1_{65}INF_{t-1} + \alpha^1_{66}BC_{t-1} + \varepsilon_{6t}$…………………………………….…....(19)

Expressing equations 14 to 19 in matrix form

$$\begin{pmatrix} 1 & -\alpha^0_{1} & -\alpha^0_{13} & -\alpha^0_{14} & -\alpha^0_{15} & -\alpha^0_{16} \\ -\alpha^0_{21} & 1 & -\alpha^0_{23} & -\alpha^0_{24} & -\alpha^0_{25} & -\alpha^0_{26} \\ -\alpha^0_{31} & -\alpha^0_{32} & 1 & -\alpha^0_{34} & -\alpha^0_{35} & -\alpha^0_{36} \\ -\alpha^0_{41} & -\alpha^0_{42} & -\alpha^0_{43} & 1 & -\alpha^0_{45} & -\alpha^0_{46} \\ -\alpha^0_{51} & -\alpha^0_{52} & -\alpha^0_{53} & -\alpha^0_{54} & 1 & -\alpha^0_{56} \\ -\alpha^0_{61} & -\alpha^0_{62} & -\alpha^0_{63} & -\alpha^0_{64} & -\alpha^0_{65} & 1 \end{pmatrix} \begin{pmatrix} INV_t \\ M2_t \\ INTR_t \\ EXR_t \\ INF_t \\ BC_t \end{pmatrix} = \begin{pmatrix} \alpha^1_{11} & \alpha^1_{12} & \alpha^1_{13} & \alpha^1_{14} & \alpha^1_{15} & \alpha^1_{16} \\ \alpha^1_{21} & \alpha^1_{22} & \alpha^1_{23} & \alpha^1_{24} & \alpha^1_{25} & \alpha^1_{26} \\ \alpha^1_{31} & \alpha^1_{32} & \alpha^1_{33} & \alpha^1_{34} & \alpha^1_{35} & \alpha^1_{36} \\ \alpha^1_{41} & \alpha^1_{42} & \alpha^1_{43} & \alpha^1_{44} & \alpha^1_{45} & \alpha^1_{46} \\ \alpha^1_{51} & \alpha^1_{52} & \alpha^1_{53} & \alpha^1_{54} & \alpha^1_{55} & \alpha^1_{56} \\ \alpha^1_{61} & \alpha^1_{62} & \alpha^1_{63} & \alpha^1_{64} & \alpha^1_{65} & \alpha^1_{66} \end{pmatrix} \begin{pmatrix} INV_{t-1} \\ M2_{t-1} \\ INTR_{t-1} \\ EXR_{t-1} \\ INF_{t-1} \\ BC_{t-1} \end{pmatrix} + \begin{pmatrix} \varepsilon_{1t} \\ \varepsilon_{2t} \\ \varepsilon_{3t} \\ \varepsilon_{4t} \\ \varepsilon_{5t} \\ \varepsilon_{6t} \end{pmatrix} \quad \text{-(20}$$

Hence, $A_0Z_t = A_1Z_{t-1} + \varepsilon_{1t}$…………………………………………………………………. (21)
Where A_0 = 6 X 6 which is a matrix of simultaneous effects of endogenous parameters;
Z_t = 6 X 1 is the matrix of column vectors of the endogenous variables;
Z_{t-1} = 6 X 1 is the matrix of column vectors of the lagged estimable endogenous variables; and
ε_{1t} = column vectors of error term in the system.
The model imposes some restrictions on some parameters of the A_0 matrix from economic and institutional knowledge to overcome the difficulties of SVAR identification due to over-parameterization that cannot be estimated by SVAR. Using the recursive approach, the upper elements above the diagonal of the entry are constrained to zero as follows;
$-\alpha^0_{1} = -\alpha^0_{13} = -\alpha^0_{14} = -\alpha^0_{15} = -\alpha^0_{16} = -\alpha^0_{23} = -\alpha^0_{24} = -\alpha^0_{25} = -\alpha^0_{26} = -\alpha^0_{34} = -\alpha^0_{35} = -\alpha^0_{36} = \alpha^0_{45} = -\alpha^0_{46} = -\alpha^0_{56} = 0$
Given the limitation imposed, the concise form of the model is given as;

$$\begin{pmatrix} 1 & 0 & 0 & 0 & 0 & 0 \\ -\alpha^0_{21} & 1 & 0 & 0 & 0 & 0 \\ -\alpha^0_{31} & -\alpha^0_{32} & 1 & 0 & 0 & 0 \\ -\alpha^0_{41} & -\alpha^0_{42} & -\alpha^0_{43} & 1 & 0 & 0 \\ -\alpha^0_{51} & -\alpha^0_{52} & -\alpha^0_{53} & -\alpha^0_{54} & 1 & 0 \\ -\alpha^0_{61} & -\alpha^0_{62} & -\alpha^0_{63} & -\alpha^0_{64} & -\alpha^0_{65} & 1 \end{pmatrix} \begin{pmatrix} INV_t \\ M2_t \\ INTR_t \\ EXR_t \\ INF_t \\ BC_t \end{pmatrix} = \begin{pmatrix} \varepsilon_{1t} \\ \varepsilon_{2t} \\ \varepsilon_{3t} \\ \varepsilon_{4t} \\ \varepsilon_{5t} \\ \varepsilon_{6t} \end{pmatrix} \quad \ldots\ldots\ldots\ldots(22)$$

Where $\varepsilon_t = \beta\eta$, and

$$\beta = \begin{pmatrix} \delta_1^2 & 0 & 0 & 0 & 0 & 0 \\ 0 & \delta_2^2 & 0 & 0 & 0 & 0 \\ 0 & 0 & \delta_3^2 & 0 & 0 & 0 \\ 0 & 0 & 0 & \delta_4^2 & 0 & 0 \\ 0 & 0 & 0 & 0 & \delta_5^2 & 0 \\ 0 & 0 & 0 & 0 & 0 & \delta_6^2 \end{pmatrix} = \text{Unit Variance i.e } Var(\eta)=1$$

$$A_0 = \begin{pmatrix} 1 & 0 & 0 & 0 & 0 & 0 \\ -\alpha^0_{21} & 1 & 0 & 0 & 0 & 0 \\ -\alpha^0_{31} & -\alpha^0_{32} & 1 & 0 & 0 & 0 \\ -\alpha^0_{41} & -\alpha^0_{42} & -\alpha^0_{43} & 1 & 0 & 0 \\ -\alpha^0_{51} & -\alpha^0_{52} & -\alpha^0_{53} & -\alpha^0_{54} & 1 & 0 \\ -\alpha^0_{61} & -\alpha^0_{62} & -\alpha^0_{63} & -\alpha^0_{64} & -\alpha^0_{65} & 1 \end{pmatrix} \begin{pmatrix} INV_t \\ M2_t \\ INTR_t \\ EXR_t \\ INF_t \\ BC_t \end{pmatrix} =$$

$$\begin{pmatrix} \delta_1^2 INV & 0 & 0 & 0 & 0 & 0 & 0 \\ 0 & \delta_2^2\,M2 & 0 & 0 & 0 & 0 & 0 \\ 0 & 0 & \delta_3^2 INTR & & 0 & 0 & 0 \\ 0 & 0 & 0 & \delta_4^2 EXR & & 0 & 0 \\ 0 & 0 & 0 & 0 & \delta_5^2 INF & 0 & 0 \\ 0 & 0 & 0 & 0 & 0 & \delta_6^2 BC & \end{pmatrix} \begin{pmatrix} \mu^{INV} \\ \mu^{M2} \\ \mu^{INTR} \\ \mu^{EXR} \\ \mu^{INF} \\ \mu^{BC} \end{pmatrix} \quad \ldots\ldots\ldots\ldots(24)$$

This implies that $A_0Z_t = A_1Z_{t-1} + \varepsilon_t$ being the normalized form of the model and reduced to $A_0e_t = \beta\eta_t$. However, $\beta\eta_t = \beta\mu_t$. Thus, the reduced form format for estimating SVAR model is specified as;

$A_0e_t = \beta\eta_t$……………………………………………………………………………..(24)

Where A_0 represent the long run matrix of contemporaneous effects,

e_t = is the column vector matrix of error for the respective variables

β = matrix of structural shocks in the model

= column vector of structural shocks in the model.

So the specification of the 'S' matrix becomes: $e_t = A_0\beta\mu_t$ =

$$e_t = A_0\beta\mu_t = \begin{pmatrix} e_t^{INV} \\ e_t^{M2} \\ e_t^{INTR} \\ e_t^{EXR} \\ e_t^{INF} \\ e_t^{BC} \end{pmatrix} = \begin{pmatrix} 1 & 0 & 0 & 0 & 0 & 0 \\ -\alpha^0{}_{21} & 1 & 0 & 0 & 0 & 0 \\ -\alpha^0{}_{41} & -\alpha^0{}_{42} & -\alpha^0{}_{43} & 1 & 0 & 0 \\ -\alpha^0{}_{41} & -\alpha^0{}_{42} & -\alpha^0{}_{43} & 1 & 0 & 0 \\ -\alpha^0{}_{51} & -\alpha^0{}_{52} & -\alpha^0{}_{53} & -\alpha^0{}_{54} & 1 & 0 \\ -\alpha^0{}_{61} & -\alpha^0{}_{62} & -\alpha^0{}_{63} & -\alpha^0{}_{64} & -\alpha^0{}_{65} & 1 \end{pmatrix} \begin{pmatrix} \mu^{INV} \\ \mu^{M2} \\ \mu^{INTR} \\ \mu^{EXR} \\ \mu^{INF} \\ \mu^{BC} \end{pmatrix} \quad \ldots\ldots(25)$$

The above indicates the initial effect of the shock on the model. We now bring in the impulse response to SVAR innovation and SVAR Forecast Error Variance Decomposition to examine the effect of limb impact in the SVAR model. The SVAR impulse responses are presented in Figure 1.

4. Results and Discussion

4.1 Descriptive Statistics

Table 1: Summary of Descriptive Statistics

Variables	INV	INTR	INF	EXR	BC	M2
Mean	14,900,000,000	13.94792	79.57674	107.7698	6977.433	7611.541
Std. Dev.	2,140,000,000	3.917062	73.37462	50.75138	50.75138	8729.885
Skewness	0.635946	0.529687	1.045878	1.829683	0.915454	0.888908
Kurtosis	2.366007	4.22098	3.153479	6.017786	2.360139	2.383159
Jarque-Bera	10.09829	13.06532	21.99501	112.4899	18.80822	17.70561
Prob.	0.006415	0.001455	0.000017	0	0.000082	0.000143

Source: Author's Compilation from Eviews 10 Output

The results in Table 1 reveals that the country on the average, invested US$14,900,000,000 and consumed US$1,34,000,000,000 each year. This means that on the average, consumption expenditure is more than investment for the period. Average rates of interest (INTR), inflation (INF), foreign exchange (EXR), bank credit (BC) and money supply are 13.95, 79.58, 107.77, 6977.43 and 7611.54 respectively. The result of skewness in Table 1 shows that all the variables (M2, INTR, EXR, INF, BC and IN) are positively skewed. This depicts that all the variables which are skewed to the right are tinted towards large values. It can be deduced from the results that majority of the series are neither substantially skewed to the left (negatively), nor to the right (positively). This suggests that our distribution does not differ from a normal distribution.

The kurtosis of a normal distribution is 3 also referred as mesokurtic. A kurtosis statistic that is above 3 is assumed to be high peaked and with a 'fat tails' called a leptokurtic distribution, but said to be low if it is less than 3 (having flat-topped curves and 'thinner tails') otherwise called platykurtic distribution. From this result, INF is normally distributed, INTR and EXR are leptokurtic while IN, BC and M2 are platykurtic. Most importantly, the result of Jarque-Bera (J-B) shows that majority of the variables are normally distributed. J-B test statistic measures the difference of the skewness and Kurtosis of the series with those from the normal series with those from the normal distribution. Most of the series reported above have probability value greater than 0.05, indicating that the series are normally distributed.

4.2 Unit Root Test Results

Table 2: Unit Root Test Results

Variables	**ADF**			**PP**		
	Level	**1st diff.**	**Status**	**Level**	**1st diff.**	**Status**
INV	-4.0214	-13.61	I(0)	-2.338	-8.6913	I(1)
P-values	0.0105	0.000		0.4099	0.000	
INTR	-2.7076	-10.4945	I(1)	-2.7368	-9.8356	I(1)
P-values	0.2356	0.000		0.2241	0.000	
INF	-2.1926	-6.3369	I(1)	-4.9474	-2.6812	I(1)
P-values	0.489	0.000		0.0005	0.000	
EXR	-2.3341	-9.6849	I(1)	-1.969	-9.5957	I(1)
P-values	0.4122	0.000		0.6118	0.000	
BC	-0.944	-11.3698	I(1)	-0.881	- 4.5773	I(1)
P-values	0.9466	0.000		0.9539	0.000	
M2	0.4542	-11.34	I(1)	-0.5539	-12.458	I(1)
P-values	0.9844	0.000		0.9796	0.000	

Source: Author's Compilation from Eviews 10 Output

Table 2 reveals the stationarity tests (ADF and PP) result for the series. The results of ADF indicate that all the series of the variables (M2, INTR, EXR, INF, BC) are stationary at first difference except INV which is stationary at levels. Also, the results of PP show that all the series of the variables are stationary at first difference. This means that the trend deviations of these variables are not stable.

4.3 Structural VAR Estimation

Since the VAR passed all the statistical diagnostic tests, we proceed to estimate SVAR model in order to achieve the objective of this study (see its result in Appendix 1). From there, we generate the Impulse Response and SVAR Forecast Error Variance Decomposition reported in Figure 1 and Table 3 respectively.

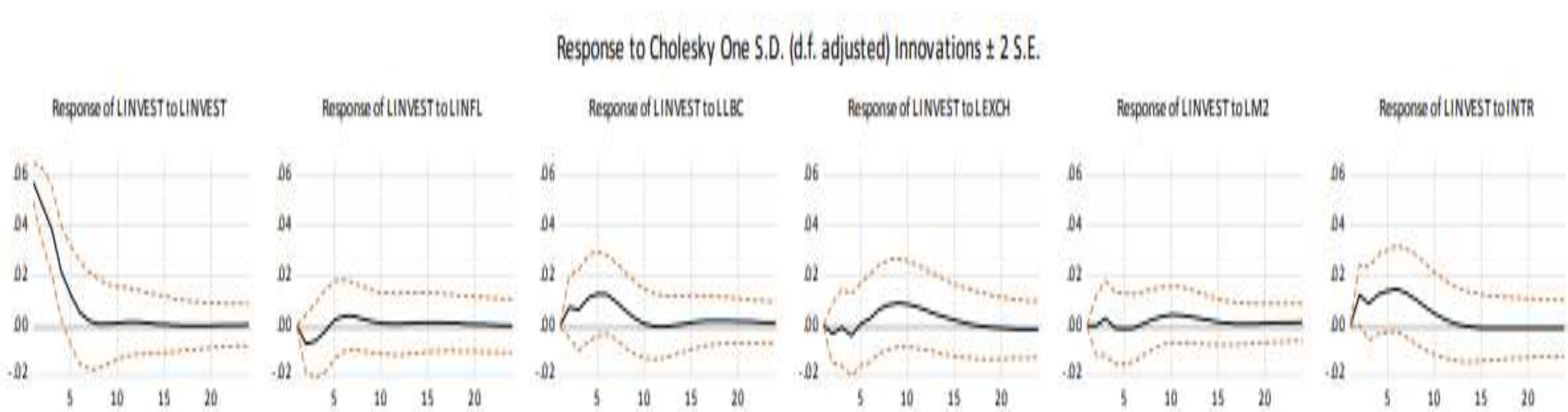

Figure 1: SVAR Impulse Responses
Source: Author's Computation from Eviews 10 Output

Table 3: Variance Decomposition

Variance Decomposition of Variable lnINV

	lnINV	lnM2	lnEXR	lnINF	lnBC	lnINTR
Short-term	0.0968	0.1210	0.3329	0.1498	0.1738	3.1346
Medium-term	0.1018	0.1801	0.3962	0.0879	0.2238	3.5128
Long-term	0.1024	0.2580	0.4110	0.0559	0.3033	3.5626
Decision on contribution	Increasing	Increasing	Increasing	Decreasing	Increasing	Increasing

Source: Author's Computation from Eviews 10 Output

The impulse response functions allow us to study the dynamic behavior of each variable of the system by determining whether an exogenous shock causes short-run or long-run changes in the variables in SVAR Model. It traces out the responsiveness of the dependent variable in the VAR to shocks or innovations from each of the other variables. In this study therefore, it shows the sign, magnitude and persistence of real and nominal shocks to the investment function.

To further determine the proportionate movement in the dependent variables that are due to its own shocks against shocks to other variables, variance decomposition is conducted. In specific terms, Impulse Response Function and Variance Decomposition are used to explain the transmission responses between dependent variables and investment when one standard deviation is normalized around the variable(s) concerned.

Thus when a one standard deviation innovation is normalized around investment, then the relationship between past values of INV show a positive decreasing shock on the current INV from the short-term (6^{th} period) to long-term (24^{th} period) as can be seen on the Figure 1. These positive shocks of past values of LnINV contributed to 9.7% (0.097), 10.18% and 10.24% percent fluctuations in LINV when decomposed in the short-term, medium-term and long-term respectively (see Table 3). So also, a shock in LnM2 results into positive increasing shock on LnINV in the short-term (6^{th} period) and medium-term (12^{th} period) and became positively steady in the long-term (24^{th} period). The resulting effect of the shocks of LnINV to LnM2 caused an increasing variation of 12.1%, 18.01% and 25.8% percent in LnINV when decomposed in the short-term, medium-term and long-term respectively. LnEXR indicates negative fluctuation in the short run, increasing in the medium term and became stable in the long run LnEXR account for 33%, 40% and 41% variation in investment in the short, medium and long run investment respectively. LnINF exacts declining negative effects initially on LnINV and became positively steady in the medium and long run. Inflation accounts for 15%, 9% and 6% respectively in the short, medium and long run respectively. LnBC increases initially, start declining in the medium term and became stable in the long run. It accounts 17%, 22% and 39% variation in investment in the short, medium and long run respectively. LnINTR impulse response to LnINV shows that INV increase initially, but start declining in the medium term and became steady in the long run.

4.4 Post-Estimation Statistical Diagnostic Tests

Diagnostic tests which include stability test, serial correlation test and normality test were carried out to avoid biased estimation. Figure 2 shows result of stability test (AR root test) of the VAR model. The result depicted in the Figure 2 shows that the model is stable as no root lies outside the AR root circles. Hence the structural vector autoregressive model satisfies the stability conditions.

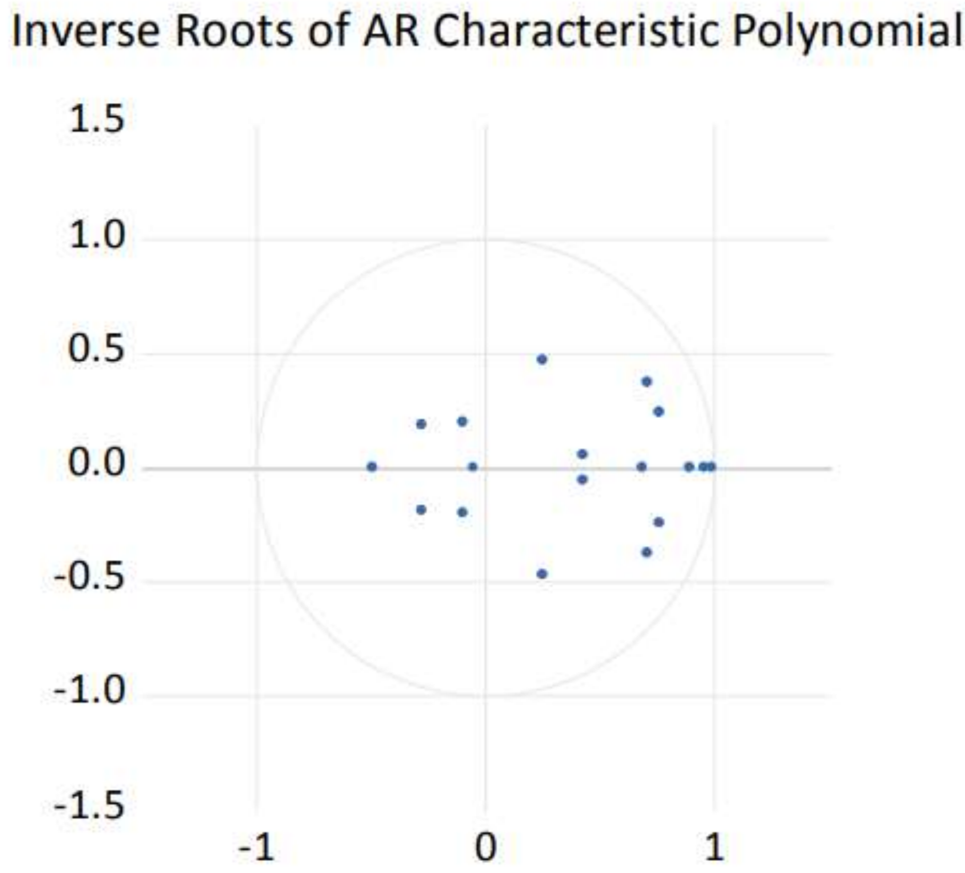

Figure 2: VAR Stability Test
Source: Author's Computation from Eviews 10 Output

Table 4: Diagnostic Tests

VAR Residual Serial Correlation LM Test

VAR Residual Serial Correlation LM Test
Null Hypothesis: No serial correlation at lag order h
Sample: 1990Q1-2019Q4
Observations: 117

Lags	LM-Stat	Prob.
1	75.87336	0.0001
2	60.97202	0.0058
3	31.30109	0.6916

Source: Author's Compilation from Eviews 10 Output

From Table 4, it can be deduced that there is no serial correlations in the series and so we fail to reject the null hypothesis which state there is no serial correlations since p values greater than 5 percent at the selected lag exist.

5. Conclusion and Policy Recommendation

The relative effectiveness of monetary policy on investment in Nigerian economy was examined in this study. To achieve the objective, the study employed short run, medium and long run SVAR. The findings showed that monetary policy is effective for influencing investment in Nigeria in short run, medium and long run. Between these variables (M2, BC, INTR, INF and EXR) of study, interest rate (INTR), bank credit (BC) and exchange (EXR) are the most effective variables for influencing investment in Nigeria as they account for higher rate of variation in it. Drawing from the foregoing, it can therefore be recommended that central bank should peg monetary policy rate at a threshold suitable to increase money supply and credit facilitation by commercial banks in order to stimulate investment in the Nigeria economy. This also suffice to put that an enabling environment for friendly interest rates is essential such that financial service providers will be able to increase lending to private sector at reasonable rates, as this will boost savings and investment.

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Appendix 1

Structural VAR Estimates
Date: 04/24/22 Time: 07:51
Sample (adjusted): 1990Q4 2019Q4
Included observations: 117 after adjustments
Estimation method: Maximum likelihood via Newton-Raphson (analytic derivatives)
Convergence achieved after 21 iterations
Structural VAR is over-identified

Model: Au = Bu where E[uu']=I

A =

1	0	0	0	0	0
C(1)	1	0	0	0	0
C(2)	C(5)	1	C(8)	C(10)	C(11)
C(3)	C(6)	0	1	0	0
C(4)	C(7)	0	0	1	C(12)
0	0	0	C(9)	0	1

B =

C(13)	0	0	0	0	0
0	C(14)	0	0	0	0
0	0	C(15)	0	0	0
0	0	0	C(16)	0	0
0	0	0	0	C(17)	0
0	0	0	0	0	C(18)

	Coefficient	Std. Error	z-Statistic	Prob.
C(1)	0.102209	0.068405	1.494177	0.1351
C(2)	0.331207	0.255897	1.294298	0.1956
C(3)	-0.964618	0.285742	-3.375852	0.0007
C(4)	-0.498475	0.136583	-3.649611	0.0003
C(5)	-0.562420	0.262996	-2.138513	0.0325
C(6)	-0.306625	0.382552	-0.801526	0.4228
C(7)	-0.236185	0.145591	-1.622254	0.1047
C(8)	-0.061509	0.067037	-0.917529	0.3589
C(9)	4.513166	0.842694	5.355642	0.0000
C(10)	-0.514336	0.165002	-3.117152	0.0018
C(11)	0.012419	0.008291	1.497941	0.1341
C(12)	-0.016106	0.004176	-3.858594	0.0001
C(13)	0.043111	0.002818	15.29706	0.0000
C(14)	0.031898	0.002085	15.29706	0.0000
C(15)	0.088606	0.005792	15.29706	0.0000
C(16)	0.131992	0.008629	15.29706	0.0000
C(17)	0.050029	0.003271	15.29706	0.0000
C(18)	1.260936	0.082430	15.29706	0.0000

Log likelihood	618.6308			
LR test for over-identification:				
Chi-square(3)	49.50606		Probability	0.0000

Estimated A matrix:					
1.000000	0.000000	0.000000	0.000000	0.000000	0.000000
0.102209	1.000000	0.000000	0.000000	0.000000	0.000000
0.331207	-0.562420	1.000000	-0.061509	-0.514336	0.012419
-0.964618	-0.306625	0.000000	1.000000	0.000000	0.000000
-0.498475	-0.236185	0.000000	0.000000	1.000000	-0.016106
0.000000	0.000000	0.000000	4.513166	0.000000	1.000000
Estimated B matrix:					
0.043111	0.000000	0.000000	0.000000	0.000000	0.000000
0.000000	0.031898	0.000000	0.000000	0.000000	0.000000
0.000000	0.000000	0.088606	0.000000	0.000000	0.000000
0.000000	0.000000	0.000000	0.131992	0.000000	0.000000
0.000000	0.000000	0.000000	0.000000	0.050029	0.000000
0.000000	0.000000	0.000000	0.000000	0.000000	1.260936
Estimated S matrix:					
0.043111	0.000000	0.000000	0.000000	0.000000	0.000000
-0.004406	0.031898	0.000000	0.000000	0.000000	0.000000
-0.003013	0.022599	0.088606	0.010582	0.025732	-0.005215
0.040234	0.009781	0.000000	0.131992	0.000000	0.000000
0.017324	0.006825	0.000000	-0.009504	0.050029	0.020308
-0.181583	-0.044142	0.000000	-0.595700	0.000000	1.260936
Estimated F matrix:					
0.648235	-0.704813	-0.248286	-1.367443	1.113625	0.260045
-0.126488	0.529094	0.143586	-1.866364	1.595084	0.315057
0.822053	-1.438869	0.333672	-4.321435	4.181722	-0.007173
-0.224137	1.042744	0.481593	1.355285	-0.543263	-0.431869
0.754126	-1.327151	-0.001444	-4.135436	3.771143	0.207159
-0.860783	1.512936	-2.587746	2.595062	-4.670813	10.93426