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Research Article

Re-examining Monetary Policy Effects and Sectoral Real Sector in Nigeria

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Abstract

The debate about overreliance on oil and its non-sustainability to resolve major economic problems in Nigeria has shifted more attention to the real sector of the Nigerian economy. Over a few years ago, the government and the monetary authority have refocused their economic and policy decisions to include the growth of the sector. In achieving this, the government has, among its policy approaches, used the monetary policy instrument to improve the sector and addressed some of the problems that have bedeviled the sector over the past years. This study reexamined the channel through which monetary policy affects each sector of the real economy, using the structural vector autoregression (SVAR). Seasonally adjusted quarterly data between the period of 2008Q1 and 2018Q4 were used for the study. The results revealed that credit and asset price channels are the most dominant monetary policy transmission channels to the sectoral real sector. However, the intervening role of credit risk in the effectiveness of monetary policy to the real sector was established, as it reordered the percentage response of sectoral outputs to shocks from the variables that represent channels of monetary policy transmission to the real sector. This study, therefore, recommends that the monetary authority should always consider credit risk, while taking real sector targeted policy decisions in order to predictably forecast the expected results of its policy actions; so as to improve real sector performance.

Keywords: Real Sector, Monetary Policy, Credit Risk, Structural Vector Autoregression (SVAR)

Introduction

In the modern-day discussions on sustainable economic development, the real sector is among the sectors that have been considered as major drivers of economic performance (Adeusi and Aluko, 2015). In the past few years in Nigeria, there has been a deliberate effort by the governments, where they have focused more on the sector, to complement and save the country from frequent economic shock from oil. The Nigerian economy has over the years been tied to its crude oil. This resulted in neglect of the real sector that was the pride of the nation and major source of foreign exchange before and after independence, until the discovery of oil. Monetary and fiscal policies have always been the major tools used by the governments across the globe, including Nigeria, to improve economic performance, and studies have been carried

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out to assess their effects on the economy (Oboh, 2017; Ajayi and Aluko, 2017 and Adegoriola, 2018).

The Nigerian government, through the monetary authority, has embarked on a series of policy actions, which are targeted at reviving the sector. Among these is the transmission of credit to the real sector, by influencing the banking system, through appropriate monetary policy instruments. This has not yielded the expected result, if the recent circulars of the Central Bank of Nigeria (CBN) to the deposit money banks are anything to go by (CBN Circular July 03, 2019; CBN Circular July 10, 2019). In July 2019, the CBN increased the minimum loan to deposit ratio of the deposit money banks from 58.5 percent to 60 percent to mandate them to increase lending to the real sector. This came with a penalty of additional cash reserve requirement of 50 percent of the lending shortfall of the target loan to deposit ratio, for banks that fail to comply with the directives. Another circular was published by the same CBN in September 2019, where it further increased the minimum loan to deposit ratio from 60 percent to 65 percent, with a stiffer sanction for non-compliance by the deposit money banks. In the statement of the CBN, the move is to facilitate greater investment in the real sector. Evidence from all of this is that the banking system sometimes limits their credit to the real sector. One of such reasons for this is the failure of the real sector investors to meet up with their loan repayment obligations, which is called credit risk or default risk in the literature (De Guimarães and Feijó, 2011; Ahiawodzi and Sackey 2013; Doriana, 2015). **This study will reexamine this process of monetary policy effects on each subsector of the real sector**; considering the intervening role of credit risk in the relationship between monetary policy and the real sector. The remaining part of this paper is organized into section two to section six. Section two focuses on the review of relevant literature; section three showcases the methodology and data used for the study; while section four details the results and discussions. In sections five and six, the conclusion and recommendation for policy implications are respectively presented.

Literature Review

Ayodeji and Oluwole (2018) used Johansen co-integration and vector error correction mechanism to examine the impact of monetary policy on the economy in Nigeria. The gross domestic product, broad money supply, interest rate, liquidity rate, and exchange rate were used as explanatory variables in the model. As revealed by the study, the exchange rate and money supply had a positive but fairly insignificant impact on the economy. Further findings showed a long-run relationship between monetary policy and the economy. The liquidity ratio was included in the model to determine output growth. However, the cash reserve ratio would have been a better variable. Liquidity ratio is the ratio of deposit that banks must hold in high liquid assets; cash reserve ratio is the ratio of deposit that must be kept with the central bank, which thereby determines the capacity of banks to lend to the productive sector.

With multiple regression analysis, Ekwe, Ogbonnaya and Omodero (2017) assessed the impact of monetary policy on the Nigerian economy. Their model contained gross domestic product, credit to private sector and money supply. They found that the monetary policy had no significant impacts on the economy, and discovered that the broad money supply had not been adequately regulated. It was further established that the bank lending rate to the private sectors was so high that it adversely affected the Nigerian economy. However, Ekwe et al., (2017) used money supply and credit to private sector as the only monetary variable to explain the Nigerian economy; this was represented by GDP. The model specification may suffer error of omitted variables, as the model is more of a closed one. Nigeria is an open economy with the rest of the world, so interest rate and exchange rate are key variables that influence the output in Nigeria.

Elem-Uche, Omekara, Okereke and Madu (2019), using the variables that reveal different types of monetary policy transmission channels, employed vector error correction model to forecast real output in Nigeria. According to the co-integration result, the monetary policy variable cointegrated with its channels of transmission, while credit channel, exchange rate and money supply channel accounted for the variations in real output in the short run. In the long-run, real output values adjusted speedily to the changes in the money supply, credit channel, interest rate and exchange rate channel. Taking some variables into account, the authors noted that the success and growth of the real sector depend on the efficacy of the monetary policy to forecast its policy outcome. They concluded that the influence of monetary policy channels is significant to stabilize Nigeria's economy

Abuka, Alinda, Minoiu, Peydro and Presbitero (2019) studied the monetary policy and bank lending in developing countries. According to the authors, a statement of weak or nonexistent bank lending channel in developing countries has existed for a long time, and they tried to revisit it, using Uganda as a case study. Their results showed that monetary policy contraction caused a reduction in bank credit supply to firms and affected economic activity, and they concluded that monetary policy can be an effective macroeconomic tool in developing countries. However, using only one country's result to generalize the experience of all the developing nations is doubtful. More data from more than one developing country should have been included in the model for balanced and more inclusive research outcomes.

CBN (2014) studied the effect of monetary policy on the Nigerian real economy at a disaggregated level with SVAR econometric technique. Using a quarterly data from the period of 1993Q1 to 2012Q4 to show how the outputs from the various subsectors respond to unanticipated monetary policy shocks, the study's result showed evidence of heterogeneous response of sectoral output to contractionary monetary policy shock. As further revealed by the forecast error variance decomposition, the most important variable that explains the variation in sectoral output is money supply, which represents the credit channel. The variations in sectoral real output are not significantly explained by monetary policy rate and exchange rate.

Patrick and Akanbi (2017) used Zambia as a case study to assess the relative importance of the channels of monetary policy transmission in a developing country. Using vector autoregressive econometric method to estimate the variables in the model, the authors found the exchange rate and credit channels to be effective monetary policy transmission channels. Further findings showed that interest rate channel was weak and asset price channel was not important. However, broad money supply was among the variables in the model specification on page 155, but what was eventually used by the authors in their analysis on page 157 and 159 was a narrow money supply. Broad money supply is a better representation of the stock of money in circulation. Patrick and Akanbi (2017) replaced it with narrow money supply without justification. This may have biased the results.

Herradi and Leroy (2019) used twelve advanced economies which included Australia, Canada, Germany, France, Italy, Denmark, Japan, United Kingdom, Sweden, Netherlands, Norway, United States, and Netherlands to assess the implication of monetary policy from a long-run perspective. Using local projections and a panel vector autoregressive method, they considered consumer price index, real gross domestic product, stock prices, national income, and nominal short term interest rate. According to the results, the expansionary monetary policy strongly increased the share of national income held by these countries, but contractionary monetary policy behaved in the opposite direction. This effect of monetary policy was caused by higher asset prices. However, few of the monetary policy transmission channels were considered; only variables that captured exchange rate, interest rate, and asset price channels were captured in their model. For instance, credit channel was not accounted for and no justification was given for this. Even if previous studies had established a weak credit channel in these countries, the authors should have mentioned it.

Ahiawodzi and Sackey (2013) conducted a study on the reasons for the credit rationing behavior of DMBs to the private sector, even when interest rates were liberalized to ensure credit allocation. According to the study, banks consider other factors in determining how they allocate their funds to borrowers. One of such variables is credit risk, which increases borrowers' rate of default, including the real sector investors. They concluded by recommending an active role by the government in the financial sector, while banks should also strengthen their loan monitoring system. This will help to control the rate of default, as against their traditional method of credit rationing. De Guimarães and Feijó (2011) confirmed in their study that the macroeconomic environment contributes significantly to banks' credit risk.

Methodology and Data

A Structural Vector Autoregressive (SVAR) econometric approach is used for this study. All the quarterly data, which were mainly sourced from CBN statistical bulletin, were adjusted for seasonal variations, using Census X-13. These are sectoral real output data on agriculture, manufacturing, construction, trade, and services and respectively represented as $y_{t\,Agriculture}$, $y_{t\,Manufacturing}$, $y_{t\,Construction}$, $y_{t\,Trade}$, $y_{t\,Services}$. Other variables in the model are interest rate (r), monetary policy rate (mpr), exchange rate (ner), maximum lending rate (mlr), asset price (Pa), broad money supply (m2), and credit to real sector (crs). Tests of stability, unit root and autocorrelation were also conducted.

Model Specification and Identification

The structure of the economy is represented by the structural form in equation (1).

$$\Lambda x_t = \varphi + \sum_{j=1}^{p} \omega_j x_{t-j} + \Psi e_t \qquad (1)$$

Λ is the coefficient matrix of vector of endogenous macroeconomic variable x_t. φ is the vector of constants. Ψ is the contemporaneous response of the variables to the shocks. ω_j is the coefficient matrix of the vector of lagged values of endogenous variables, where $\omega_j = 1,\ldots,p$. x_t is a vector of macroeconomic variables. e_t is a vector of serially uncorrelated structural shocks with zero mean and diagonal variance co-variance matrix that is time invariant, represented as $\mathrm{E}\left[\varepsilon_t \varepsilon_t^{'}\right] = \Omega$; where $e_t \sim iid\ N_n(0,\Omega)$. This means the random variables are independent, identically distributed with the same distributions, but may be contemporaneously correlated. The structural equation is represented below in its implicit form:

$$mpr_t = f\begin{pmatrix} r_t, ner_t, p_{a_t}, mlr_t, cr_t, crs_t, m2_t, y_t, mpr_{t-j}, r_{t-j}, ner_{t-j}, p_{a_{t-j}}, \\ mlr_{t-j}, cr_{t-j}, crs_{t-j}, m2_{t-j}, y_{t-j} \end{pmatrix} \quad (2)$$

$$r_t = f\begin{pmatrix} mpr_t, ner_t, p_{a_t}, mlr_t, cr_t, crs_t, m2_t, y_t, mpr_{t-j}, r_{t-j}, ner_{t-j}, p_{a_{t-j}}, \\ mlr_{t-j}, cr_{t-j}, crs_{t-j}, m2_{t-j}, y_{t-j} \end{pmatrix} \quad (3)$$

$$ner_t = f\begin{pmatrix} mpr_t, r_t, p_{a_t}, mlr_t, cr_t, crs_t, m2_t, y_t, mpr_{t-j}, r_{t-j}, ner_{t-j}, p_{a_{t-j}}, \\ mlr_{t-j}, cr_{t-j}, crs_{t-j}, m2_{t-j}, y_{t-j} \end{pmatrix} \quad (4)$$

$$p_{at} = f\begin{pmatrix} mpr_t, r_t, ner_t, mlr_t, cr_t, crs_t, m2_t, y_t, mpr_{t-j}, r_{t-j}, ner_{t-j}, p_{a_{t-j}}, \\ mlr_{t-j}, cr_{t-j}, crs_{t-j}, m2_{t-j}, y_{t-j} \end{pmatrix} \quad (5)$$

$$mlr_t = f\begin{pmatrix} mpr_t, r_t, ner_t, p_{at}, cr_t, crs_t, m2_t, y_t, mpr_{t-j}, r_{t-j}, ner_{t-j}, p_{a_{t-j}}, \\ mlr_{t-j}, cr_{t-j}, crs_{t-j}, m2_{t-j}, y_{t-j} \end{pmatrix} \quad (6)$$

$$cr_t = f\begin{pmatrix} mpr_t, r_t, ner_t, p_{at}, mlr_t, crs_t, m2_t, y_t, mpr_{t-j}, r_{t-j}, ner_{t-j}, p_{a_{t-j}}, \\ mlr_{t-j}, cr_{t-j}, crs_{t-j}, m2_{t-j}, y_{t-j} \end{pmatrix} \quad (7)$$

$$crs_t = f\begin{pmatrix} mpr_t, r_t, ner_t, p_{at}, mlr_t, cr_t, m2_t, y_t, mpr_{t-j}, r_{t-j}, ner_{t-j}, p_{a_{t-j}}, \\ mlr_{t-j}, cr_{t-j}, crs_{t-j}, m2_{t-j}, y_{t-j} \end{pmatrix} \quad (8)$$

$$m2_t = f\begin{pmatrix} mpr_t, r_t, ner_t, p_{at}, mlr_t, cr_t, crs_t, y_t, mpr_{t-j}, r_{t-j}, ner_{t-j}, p_{a_{t-j}}, \\ mlr_{t-j}, cr_{t-j}, crs_{t-j}, m2_{t-j}, y_{t-j} \end{pmatrix} \quad (9)$$

$$y_t = f\begin{pmatrix} mpr_t, r_t, ner_t, p_{at}, mlr_t, cr_t, crs_t, m2_t, mpr_{t-j}, r_{t-j}, ner_{t-j}, p_{a_{t-j}}, \\ mlr_{t-j}, cr_{t-j}, crs_{t-j}, m2_{t-j}, y_{t-j} \end{pmatrix} \quad (10)$$

y_t is the aggregate real sector. At the sectoral level, y_t is respectively replaced by $y_{t\,Agriculture}$, $y_{t\,Manufacturing}$, $y_{t\,Construction}$, $y_{t\,Trade}$ and $y_{t\,Services}$. In the equations, each endogenous variable is a function of all other endogenous variables and lag values of all the endogenous variables in the model. By the explicit form, the equations are represented below:

$$mpr_t = \varphi_{10} - r_t - ner_t - p_{a_t} - mlr_t - cr_t - crs_t - m2_t - y_t + \sum_{t-j}^{p} \varphi_{11} mpr_{t-j} + \sum_{t-j}^{p} \varphi_{12} r_{t-j} + \sum_{t-j}^{p} \varphi_{13} ner_{t-j} + \sum_{t-j}^{p} \varphi_{14} p_{a_{t-j}} + \sum_{t-j}^{p} \varphi_{15} mlr_{t-j} + \sum_{t-j}^{p} \varphi_{16} cr_{t-j} + \sum_{t-j}^{p} \varphi_{17} crs_{t-j} + \sum_{t-j}^{p} \varphi_{18} m2_{t-j} + \sum_{t-j}^{p} \varphi_{19} y_{t-j} + e_t^{mpr_t} \tag{11}$$

$$r_t = \varphi_{20} - mpr_t - ner_t - p_{a_t} - mlr_t - cr_t - crs_t - m2_t - y_t + \sum_{t-j}^{p} \varphi_{21} mpr_{t-j} + \sum_{t-j}^{p} \varphi_{22} r_{t-j} + \sum_{t-j}^{p} \varphi_{23} ner_{t-j} + \sum_{t-j}^{p} \varphi_{24} p_{a_{t-j}} + \sum_{t-j}^{p} \varphi_{25} mlr_{t-j} + \sum_{t-j}^{p} \varphi_{26} cr_{t-j} + \sum_{t-j}^{p} \varphi_{27} crs_{t-j} + \sum_{t-j}^{p} \varphi_{28} m2_{t-j} + \sum_{t-j}^{p} \varphi_{29} y_{t-j} + e_t^{r_t} \tag{12}$$

$$ner_t = \varphi_{30} - mpr_t - r_t - p_{a_t} - mlr_t - cr_t - crs_t - m2_t - y_t + \sum_{t-j}^{p} \varphi_{31} mpr_{t-j} + \sum_{t-j}^{p} \varphi_{32} r_{t-j} + \sum_{t-j}^{p} \varphi_{33} ner_{t-j} + \sum_{t-j}^{p} \varphi_{34} p_{a_{t-j}} + \sum_{t-j}^{p} \varphi_{35} mlr_{t-j} + \sum_{t-j}^{p} \varphi_{36} cr_{t-j} + \sum_{t-j}^{p} \varphi_{37} crs_{t-j} + \sum_{t-j}^{p} \varphi_{38} m2_{t-j} + \sum_{t-j}^{p} \varphi_{39} y_{t-j} + e_t^{ner_t} \tag{13}$$

$$p_{a_t} = \varphi_{40} - mpr_t - r_t - ner_t - mlr_t - cr_t - crs_t - m2_t - y_t + \sum_{t-j}^{p} \varphi_{41} mpr_{t-j} + \sum_{t-j}^{p} \varphi_{42} r_{t-j} + \sum_{t-j}^{p} \varphi_{43} ner_{t-j} + \sum_{t-j}^{p} \varphi_{44} p_{a_{t-j}} + \sum_{t-j}^{p} \varphi_{45} mlr_{t-j} + \sum_{t-j}^{p} \varphi_{46} cr_{t-j} + \sum_{t-j}^{p} \varphi_{47} crs_{t-j} + \sum_{t-j}^{p} \varphi_{48} m2_{t-j} + \sum_{t-j}^{p} \varphi_{49} y_{t-j} + e_t^{p_{at}} \tag{14}$$

$$mlr_t = \varphi_{50} - mpr_t - r_t - ner_t - p_{at} - cr_t - crs_t - m2_t - y_t + \sum_{t-j}^{p} \varphi_{51} mpr_{t-j} + \sum_{t-j}^{p} \varphi_{52} r_{t-j} + \sum_{t-j}^{p} \varphi_{53} ner_{t-j} + \sum_{t-j}^{p} \varphi_{54} p_{a_{t-j}} + \sum_{t-j}^{p} \varphi_{55} mlr_{t-j} + \sum_{t-j}^{p} \varphi_{56} cr_{t-j} + \sum_{t-j}^{p} \varphi_{57} crs_{t-j} + \sum_{t-j}^{p} \varphi_{58} m2_{t-j} + \sum_{t-j}^{p} \varphi_{59} y_{t-j} + e_t^{mlr_t} \tag{15}$$

$$cr_t = \varphi_{60} - mpr_t - r_t - ner_t - p_{at} - mlr_t - crs_t - m2_t - y_t + \sum_{t-j}^{p} \varphi_{61} mpr_{t-j} + \sum_{t-j}^{p} \varphi_{62} r_{t-j}$$
$$+ \sum_{t-j}^{p} \varphi_{63} ner_{t-j} + \sum_{t-j}^{p} \varphi_{64} p_{a_{t-j}} + \sum_{t-j}^{p} \varphi_{65} mlr_{t-j} + \sum_{t-j}^{p} \varphi_{66} cr_{t-j} + \sum_{t-j}^{p} \varphi_{67} crs_{t-j} + \sum_{t-j}^{p} \varphi_{68} m2_{t-j} \quad (16)$$
$$+ \sum_{t-j}^{p} \varphi_{69} y_{t-j} + e_t^{cr_t}$$

$$crs_t = \varphi_{70} - mpr_t - r_t - ner_t - p_{at} - mlr_t - cr_t - m2_t - y_t + \sum_{t-j}^{p} \varphi_{71} mpr_{t-j} + \sum_{t-j}^{p} \varphi_{72} r_{t-j}$$
$$+ \sum_{t-j}^{p} \varphi_{73} ner_{t-j} + \sum_{t-j}^{p} \varphi_{74} p_{a_{t-j}} + \sum_{t-j}^{p} \varphi_{75} mlr_{t-j} + \sum_{t-j}^{p} \varphi_{76} cr_{t-j} + \sum_{t-j}^{p} \varphi_{77} crs_{t-j} + \sum_{t-j}^{p} \varphi_{78} m2_{t-j} \quad (17)$$
$$+ \sum_{t-j}^{p} \varphi_{79} y_{t-j} + e_t^{crs_t}$$

$$m2_t = \varphi_{80} - mpr_t - r_t - ner_t - p_{at} - mlr_t - cr_t - crs_t - y_t + \sum_{t-j}^{p} \varphi_{81} mpr_{t-j} + \sum_{t-j}^{p} \varphi_{82} r_{t-j}$$
$$+ \sum_{t-j}^{p} \varphi_{83} ner_{t-j} + \sum_{t-j}^{p} \varphi_{84} p_{a_{t-j}} + \sum_{t-j}^{p} \varphi_{85} mlr_{t-j} + \sum_{t-j}^{p} \varphi_{86} cr_{t-j} + \sum_{t-j}^{p} \varphi_{87} crs_{t-j} + \sum_{t-j}^{p} \varphi_{88} m2_{t-j} \quad (18)$$
$$+ \sum_{t-j}^{p} \varphi_{89} y_{t-j} + e_t^{m2_t}$$

$$y_t = \varphi_{90} - mpr_t - r_t - ner_t - p_{at} - mlr_t - cr_t - crs_t - m2_t + \sum_{t-j}^{p} \varphi_{91} mpr_{t-j} + \sum_{t-j}^{p} \varphi_{92} r_{t-j}$$
$$+ \sum_{t-j}^{p} \varphi_{93} ner_{t-j} + \sum_{t-j}^{p} \varphi_{94} p_{a_{t-j}} + \sum_{t-j}^{p} \varphi_{95} mlr_{t-j} + \sum_{t-j}^{p} \varphi_{96} cr_{t-j} + \sum_{t-j}^{p} \varphi_{97} crs_{t-j} + \sum_{t-j}^{p} \varphi_{98} m2_{t-j} \quad (19)$$
$$+ \sum_{t-j}^{p} \varphi_{99} y_{t-j} + e_t^{y_t}$$

The structural shocks $e_t^{mpr_t}, e_t^{r_t}, e_t^{ner_t}, e_t^{p_{at}}, e_t^{mlr_t}, e_t^{cr_t}, e_t^{crs_t}, e_t^{m2_t}, e_t^{y_t}$ are independent, identically distributed; the variance co-variance matrix is constant over time and the structural shocks are serially uncorrelated with zero mean as shown in equation (20).

$$\begin{pmatrix} e_t^{mpr_t} \\ e_t^{r_t} \\ e_t^{ner_t} \\ e_t^{p_{at}} \\ e_t^{mlr_t} \\ e_t^{cr_t} \\ e_t^{crs_t} \\ e_t^{m2_t} \\ e_t^{y_t} \end{pmatrix} iid \left(\begin{pmatrix} 0 \\ 0 \\ 0 \\ 0 \\ 0 \\ 0 \\ 0 \\ 0 \\ 0 \end{pmatrix}, \begin{pmatrix} \sigma^2_{mpr_t} & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 \\ 0 & \sigma^2_{r_t} & 0 & 0 & 0 & 0 & 0 & 0 & 0 \\ 0 & 0 & \sigma^2_{ner_t} & 0 & 0 & 0 & 0 & 0 & 0 \\ 0 & 0 & 0 & \sigma^2_{p_{at}} & 0 & 0 & 0 & 0 & 0 \\ 0 & 0 & 0 & 0 & \sigma^2_{mlr_t} & 0 & 0 & 0 & 0 \\ 0 & 0 & 0 & 0 & 0 & \sigma^2_{cr_t} & 0 & 0 & 0 \\ 0 & 0 & 0 & 0 & 0 & 0 & \sigma^2_{crs_t} & 0 & 0 \\ 0 & 0 & 0 & 0 & 0 & 0 & 0 & \sigma^2_{m2_t} & 0 \\ 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & \sigma^2_{y_t} \end{pmatrix} \right) \tag{20}$$

Representing equations (11) to (19) in matrix form, all the endogenous variables in each equation are expressed in terms of lag values of other endogenous variables:

$$\begin{pmatrix} 1 & c_{12} & c_{13} & c_{14} & c_{15} & c_{16} & c_{17} & c_{18} & c_{19} \\ c_{21} & 1 & c_{23} & c_{24} & c_{25} & c_{26} & c_{27} & c_{28} & c_{29} \\ c_{31} & c_{32} & 1 & c_{34} & c_{35} & c_{36} & c_{37} & c_{38} & c_{39} \\ c_{41} & c_{42} & c_{43} & 1 & c_{45} & c_{46} & c_{47} & c_{48} & c_{49} \\ c_{51} & c_{52} & c_{53} & c_{54} & 1 & c_{56} & c_{57} & c_{58} & c_{59} \\ c_{61} & c_{62} & c_{63} & c_{64} & c_{65} & 1 & c_{67} & c_{68} & c_{69} \\ c_{71} & c_{72} & c_{73} & c_{74} & c_{75} & c_{76} & 1 & c_{78} & c_{79} \\ c_{81} & c_{82} & c_{83} & c_{84} & c_{85} & c_{86} & c_{87} & 1 & c_{89} \\ c_{91} & c_{92} & c_{93} & c_{94} & c_{95} & c_{96} & c_{97} & c_{98} & 1 \end{pmatrix} \begin{pmatrix} mpr_t \\ r_t \\ ner_t \\ p_{at} \\ mlr_t \\ cr_t \\ crs_t \\ m2_t \\ y_t \end{pmatrix} = \begin{pmatrix} \varphi_{10} \\ \varphi_{20} \\ \varphi_{30} \\ \varphi_{40} \\ \varphi_{50} \\ \varphi_{60} \\ \varphi_{70} \\ \varphi_{80} \\ \varphi_{90} \end{pmatrix} + \begin{pmatrix} \omega_{11} & \omega_{12} & \omega_{13} & \omega_{14} & \omega_{15} & \omega_{16} & \omega_{17} & \omega_{18} & \omega_{19} \\ \omega_{21} & \omega_{22} & \omega_{23} & \omega_{24} & \omega_{25} & \omega_{26} & \omega_{27} & \omega_{28} & \omega_{29} \\ \omega_{31} & \omega_{32} & \omega_{33} & \omega_{34} & \omega_{35} & \omega_{36} & \omega_{37} & \omega_{38} & \omega_{39} \\ \omega_{41} & \omega_{42} & \omega_{43} & \omega_{44} & \omega_{45} & \omega_{46} & \omega_{47} & \omega_{48} & \omega_{49} \\ \omega_{51} & \omega_{52} & \omega_{53} & \omega_{54} & \omega_{55} & \omega_{56} & \omega_{57} & \omega_{58} & \omega_{59} \\ \omega_{61} & \omega_{62} & \omega_{63} & \omega_{64} & \omega_{65} & \omega_{66} & \omega_{67} & \omega_{68} & \omega_{69} \\ \omega_{71} & \omega_{72} & \omega_{73} & \omega_{74} & \omega_{75} & \omega_{76} & \omega_{77} & \omega_{78} & \omega_{79} \\ \omega_{81} & \omega_{82} & \omega_{83} & \omega_{84} & \omega_{85} & \omega_{86} & \omega_{87} & \omega_{88} & \omega_{89} \\ \omega_{91} & \omega_{92} & \omega_{93} & \omega_{94} & \omega_{95} & \omega_{96} & \omega_{97} & \omega_{98} & \omega_{99} \end{pmatrix} *$$

$$\begin{pmatrix} mpr_{t-j} \\ r_{t-j} \\ ner_{t-j} \\ p_{at-j} \\ mlr_{t-j} \\ cr_{t-j} \\ crs_{t-j} \\ m2_{t-j} \\ y_{t-j} \end{pmatrix} + \begin{pmatrix} e_t^{mpr_t} \\ e_t^{r_t} \\ e_t^{ner_t} \\ e_t^{p_{at}} \\ e_t^{mlr_t} \\ e_t^{cr_t} \\ e_t^{crs_t} \\ e_t^{m2_t} \\ e_t^{y_t} \end{pmatrix} \tag{21}$$

The structural form equations above cannot be estimated with OLS. This is the major problem with structural equations because the regressors are correlated with the error term and this violates an important assumption of OLS; as a result, no reliable estimates can be arrived at (Claudia and Massimiliano 2014). This problem can, however, be solved if equation (1) is considered in its reduced form VAR, by pre-multiplying the structural equation by the inverse of the coefficient matrix of the vector of the endogenous macroeconomic variables x_t .

$\Lambda^{-1}\Lambda x_t = \Lambda^{-1}\varphi + \sum_{j=1}^{p} \Lambda^{-1}\omega_j x_{t-j} + \Lambda^{-1}\Psi e_t$; This can further be simplified as $x_t = \Lambda^{-1}\varphi + \sum_{j=1}^{p} \Lambda^{-1}\omega_j x_{t-j} + \Lambda^{-1}\Psi e_t$; Hence $x_t = d + \sum_{j=1}^{p} D_j x_{t-j} + \varepsilon_t$. Where $d = \Lambda^{-1}\varphi$; $D_j = \Lambda^{-1}\omega_j$; $\varepsilon_t = \Lambda^{-1}\Psi e_t$; $For \quad j = 1, \ldots, p$

$\sum_{\varepsilon} = \mathrm{E}\left(\varepsilon_t \varepsilon_t^{'}\right) = \Lambda^{-1}\Psi\mathrm{E}\left(e_t e_t^{'}\right)\Lambda^{-1'}\Psi^{'} = \Lambda^{-1}\Psi\Psi^{-1}\Omega\Lambda^{-1'} = \Lambda^{-1}\Omega\Lambda^{-1^{'}}$; $\Psi\Psi^{-1} = 1$; $\sum_{\varepsilon} = \Lambda^{-1}\Omega\Lambda^{-1^{'}}$;
$\varepsilon_t \sim iid\ N_n\left(0, \sum_{\varepsilon}\right)$

The reduced form VAR of equation (21) now becomes:

$$\begin{pmatrix} mpr_t \\ r_t \\ ner_t \\ p_{at} \\ mlr_t \\ cr_t \\ crs_t \\ m2_t \\ y_t \end{pmatrix} = \begin{pmatrix} d_{10} \\ d_{20} \\ d_{30} \\ d_{40} \\ d_{50} \\ d_{60} \\ d_{70} \\ d_{80} \\ d_{90} \end{pmatrix} + \begin{pmatrix} D_{11} & D_{12} & D_{13} & D_{14} & D_{15} & D_{16} & D_{17} & D_{18} & D_{19} \\ D_{21} & D_{22} & D_{23} & D_{24} & D_{25} & D_{26} & D_{27} & D_{28} & D_{29} \\ D_{31} & D_{32} & D_{33} & D_{34} & D_{35} & D_{36} & D_{37} & D_{38} & D_{39} \\ D_{41} & D_{42} & D_{43} & D_{44} & D_{45} & D_{46} & D_{47} & D_{48} & D_{49} \\ D_{51} & D_{52} & D_{53} & D_{54} & D_{55} & D_{56} & D_{57} & D_{58} & D_{59} \\ D_{61} & D_{62} & D_{63} & D_{64} & D_{65} & D_{66} & D_{67} & D_{68} & D_{69} \\ D_{71} & D_{72} & D_{73} & D_{74} & D_{75} & D_{76} & D_{77} & D_{78} & D_{79} \\ D_{81} & D_{82} & D_{83} & D_{84} & D_{85} & D_{86} & D_{87} & D_{88} & D_{89} \\ D_{91} & D_{92} & D_{93} & D_{94} & D_{95} & D_{96} & D_{97} & D_{98} & D_{99} \end{pmatrix} * \begin{pmatrix} mpr_{t-j} \\ r_{t-j} \\ ner_{t-j} \\ p_{at-j} \\ mlr_{t-j} \\ cr_{t-j} \\ crs_{t-j} \\ m2_{t-j} \\ y_{t-j} \end{pmatrix} + \begin{pmatrix} \varepsilon_t^{mpr_t} \\ \varepsilon_t^{r_t} \\ \varepsilon_t^{ner_t} \\ \varepsilon_t^{p_{at}} \\ \varepsilon_t^{mlr_t} \\ \varepsilon_t^{cr_t} \\ \varepsilon_t^{crs_t} \\ \varepsilon_t^{m2_t} \\ \varepsilon_t^{y_t} \end{pmatrix} \quad (22)$$

$\varepsilon_t^{mpr_t}, \varepsilon_t^{r_t}, \varepsilon_t^{ner_t}, \varepsilon_t^{p_{at}}, \varepsilon_t^{mlr_t}, \varepsilon_t^{cr_t}, \varepsilon_t^{crs_t}, \varepsilon_t^{m2_t}, \varepsilon_t^{y_t}$ are the reduced-form VAR error terms and are also serially uncorrelated wi
zero mean and independent, identically distributed; the variance co-variance matrix constant over time.

$$\begin{pmatrix} \varepsilon_t^{mpr_t} \\ \varepsilon_t^{r_t} \\ \varepsilon_t^{ner_t} \\ \varepsilon_t^{p_{at}} \\ \varepsilon_t^{mlr_t} \\ \varepsilon_t^{cr_t} \\ \varepsilon_t^{crs_t} \\ \varepsilon_t^{m2_t} \\ \varepsilon_t^{y_t} \end{pmatrix} iid \left(\begin{pmatrix} 0 \\ 0 \\ 0 \\ 0 \\ 0 \\ 0 \\ 0 \\ 0 \\ 0 \end{pmatrix}, \begin{pmatrix} \sigma^2_{mpr_t} & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 \\ 0 & \sigma^2_{r_t} & 0 & 0 & 0 & 0 & 0 & 0 & 0 \\ 0 & 0 & \sigma^2_{ner_t} & 0 & 0 & 0 & 0 & 0 & 0 \\ 0 & 0 & 0 & \sigma^2_{p_{at}} & 0 & 0 & 0 & 0 & 0 \\ 0 & 0 & 0 & 0 & \sigma^2_{mlr_t} & 0 & 0 & 0 & 0 \\ 0 & 0 & 0 & 0 & 0 & \sigma^2_{cr_t} & 0 & 0 & 0 \\ 0 & 0 & 0 & 0 & 0 & 0 & \sigma^2_{crs_t} & 0 & 0 \\ 0 & 0 & 0 & 0 & 0 & 0 & 0 & \sigma^2_{m2_t} & 0 \\ 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & \sigma^2_{y_t} \end{pmatrix} \right) \quad (24)$$

However, the structure of the economy cannot be explained by the reduced-form VAR, and as such, reduced-form error terms ε_t cannot be interpreted as structural shocks. Hence, it becomes impossible to uniquely determine the parameters $\varphi, \Lambda, \omega_1, \ldots, \omega_p, \Omega$ from $d, D_1, \ldots, D_p, \sum_{\varepsilon}$. The shocks must be correctly identified before the estimated SVAR can be used to generate impulse response functions that explain the time-dynamic effects of the monetary shocks on the sectoral real outputs. One of the solutions to this identification problem, in literature, is by zero short-run restrictions, equally known as Cholesky identification, recursive identification. According to Cooley and LeRoy (1985), the recursive identification procedure is arbitrary and it cannot be interpreted as a structural model since different variable ordering yields different structural parameters. A non-recursive restriction on the contemporaneous interactions among the variables in the model was introduced in the works of Blanchard and Watson (1986) Bernanke (1986) and Sims (1986), where identification allows for theory-based restrictions which represent a meaningful relationship between the variables and the structural shocks. As long as the identification conditions are met, the restrictions may not be a triangular form or recursive. If Ω is normalized as an identity matrix in which $\Omega = \mathrm{I}_k$, $\sum_{\varepsilon}$ becomes $\sum_{\varepsilon} = \Lambda^{-1}\Lambda^{-1^{'}}$, which is symmetric and represents a system of $K\left(K+1\right)/2$ independent equations. The system in this instance can then be solved for the unknown parameters Λ^{-1}, in as much as the number of unknown parameters in Λ^{-1} is not more than the number of independent equations in $\sum_{\varepsilon} = \Lambda^{-1}\Lambda^{-1'}$. This will require the imposition of additional restrictions on selected elements of Λ^{-1} by making them equal to zero. The restriction is $K(K-1)/2$ zero parameters in matrix Λ. Λ is the coefficient matrix of the vector of endogenous variables in the model. A theoretical fact is used to identify the model below.

$$\Lambda x_t = \begin{pmatrix} 1 & c_{12} & 0 & 0 & 0 & 0 & c_{17} & 0 & 0 \\ c_{21} & 1 & c_{23} & 0 & 0 & 0 & 0 & 0 & c_{29} \\ 0 & c_{32} & 1 & 0 & 0 & 0 & 0 & 0 & 0 \\ 0 & 0 & 0 & 1 & 0 & 0 & 0 & 0 & 0 \\ 0 & 0 & 0 & 0 & 1 & 0 & 0 & 0 & c_{59} \\ 0 & 0 & 0 & 0 & c_{65} & 1 & 0 & 0 & 0 \\ 0 & c_{72} & 0 & 0 & c_{75} & c_{76} & 1 & 0 & 0 \\ 0 & 0 & 0 & 0 & 0 & 0 & 0 & 1 & c_{89} \\ c_{91} & c_{92} & c_{93} & c_{94} & c_{95} & c_{96} & c_{97} & c_{98} & 1 \end{pmatrix} \begin{pmatrix} mpr_t \\ r_t \\ ner_t \\ p_{at} \\ mlr_t \\ cr_t \\ crs_t \\ m2_t \\ y_{t\,Agriculture} \end{pmatrix}$$

$$\Lambda x_t = \begin{pmatrix} 1 & c_{12} & 0 & 0 & 0 & 0 & c_{17} & 0 & 0 \\ c_{21} & 1 & c_{23} & 0 & 0 & 0 & 0 & 0 & c_{29} \\ 0 & c_{32} & 1 & 0 & 0 & 0 & 0 & 0 & 0 \\ 0 & 0 & 0 & 1 & 0 & 0 & 0 & 0 & 0 \\ 0 & 0 & 0 & 0 & 1 & 0 & 0 & 0 & c_{59} \\ 0 & 0 & 0 & 0 & c_{65} & 1 & 0 & 0 & 0 \\ 0 & c_{72} & 0 & 0 & c_{75} & c_{76} & 1 & 0 & 0 \\ 0 & 0 & 0 & 0 & 0 & 0 & 0 & 1 & c_{89} \\ c_{91} & c_{92} & c_{93} & c_{94} & c_{95} & c_{96} & c_{97} & c_{98} & 1 \end{pmatrix} \begin{pmatrix} mpr_t \\ r_t \\ ner_t \\ p_{at} \\ mlr_t \\ cr_t \\ crs_t \\ m2_t \\ y_{t\,Manufacturing} \end{pmatrix}$$

$$\Lambda x_t = \begin{pmatrix} 1 & c_{12} & 0 & 0 & 0 & 0 & c_{17} & 0 & 0 \\ c_{21} & 1 & c_{23} & 0 & 0 & 0 & 0 & 0 & c_{29} \\ 0 & c_{32} & 1 & 0 & 0 & 0 & 0 & 0 & 0 \\ 0 & 0 & 0 & 1 & 0 & 0 & 0 & 0 & 0 \\ 0 & 0 & 0 & 0 & 1 & 0 & 0 & 0 & c_{59} \\ 0 & 0 & 0 & 0 & c_{65} & 1 & 0 & 0 & 0 \\ 0 & c_{72} & 0 & 0 & c_{75} & c_{76} & 1 & 0 & 0 \\ 0 & 0 & 0 & 0 & 0 & 0 & 0 & 1 & c_{89} \\ c_{91} & c_{92} & c_{93} & c_{94} & c_{95} & c_{96} & c_{97} & c_{98} & 1 \end{pmatrix} \begin{pmatrix} mpr_t \\ r_t \\ ner_t \\ p_{at} \\ mlr_t \\ cr_t \\ crs_t \\ m2_t \\ y_{t\,Construction} \end{pmatrix}$$

$$\Lambda x_t = \begin{pmatrix} 1 & c_{12} & 0 & 0 & 0 & 0 & c_{17} & 0 & 0 \\ c_{21} & 1 & c_{23} & 0 & 0 & 0 & 0 & 0 & c_{29} \\ 0 & c_{32} & 1 & 0 & 0 & 0 & 0 & 0 & 0 \\ 0 & 0 & 0 & 1 & 0 & 0 & 0 & 0 & 0 \\ 0 & 0 & 0 & 0 & 1 & 0 & 0 & 0 & c_{59} \\ 0 & 0 & 0 & 0 & c_{65} & 1 & 0 & 0 & 0 \\ 0 & c_{72} & 0 & 0 & c_{75} & c_{76} & 1 & 0 & 0 \\ 0 & 0 & 0 & 0 & 0 & 0 & 0 & 1 & c_{89} \\ c_{91} & c_{92} & c_{93} & c_{94} & c_{95} & c_{96} & c_{97} & c_{98} & 1 \end{pmatrix} \begin{pmatrix} mpr_t \\ r_t \\ ner_t \\ p_{at} \\ mlr_t \\ cr_t \\ crs_t \\ m2_t \\ y_{t\,Trade} \end{pmatrix}$$

$$\Lambda x_t = \begin{pmatrix} 1 & c_{12} & 0 & 0 & 0 & 0 & c_{17} & 0 & 0 \\ c_{21} & 1 & c_{23} & 0 & 0 & 0 & 0 & 0 & c_{29} \\ 0 & c_{32} & 1 & 0 & 0 & 0 & 0 & 0 & 0 \\ 0 & 0 & 0 & 1 & 0 & 0 & 0 & 0 & 0 \\ 0 & 0 & 0 & 0 & 1 & 0 & 0 & 0 & c_{59} \\ 0 & 0 & 0 & 0 & c_{65} & 1 & 0 & 0 & 0 \\ 0 & c_{72} & 0 & 0 & c_{75} & c_{76} & 1 & 0 & 0 \\ 0 & 0 & 0 & 0 & 0 & 0 & 0 & 1 & c_{89} \\ c_{91} & c_{92} & c_{93} & c_{94} & c_{95} & c_{96} & c_{97} & c_{98} & 1 \end{pmatrix} \begin{pmatrix} mpr_t \\ r_t \\ ner_t \\ p_{at} \\ mlr_t \\ cr_t \\ crs_t \\ m2_t \\ y_{t\,Services} \end{pmatrix}$$

c_{12} represents the contemporaneous response of monetary policy rate to shocks from interest rate. This is theoretically and empirically valid as the monetary authority will adjust the monetary policy rate based on the activities in the banking system and changes in interest rate. c_{17} represents the contemporaneous response of monetary policy rate to shocks from credit to real sector. The bank lending rate and short-term In theory, changes to official interest rate lead to changes in the market interest rate. c_{23} represents the contemporaneous response of interest rate to shocks from exchange rate. A fall in exchange rate will cause assets denominated in local currency to suffer exchange rate risk, making foreign investors demand for higher interest rate in investing in domestic assets. c_{29} represents the contemporaneous response of interest rate to shocks from sectoral real outputs. An increase in real output requires more money to purchase goods and services. This makes owners of real and financial assets offer them for sale thereby bringing down prices of these assets. This, however, leads to an increase in interest rate. c_{32} represents the contemporaneous response of exchange rate to shocks from interest rate. As domestic interest rate decreases, returns on domestic assets also decrease compared to foreign assets, leading to high capital outflows and depreciation of the domestic currency, which affects the exchange rate. c_{59} represents the contemporaneous response of maximum lending rate to sectoral real output. Perceived risky productive investors are one of the categories of banks' customers. The maximum lending rate is the rate at which credit is advanced to this category of customers for investment purposes, which ultimately leads to an increase in real output. c_{72} represents the contemporaneous response of credit to real sector to interest rate. When market interest rate declines, investment and credit to real sector are expected to increase. c_{75} represents the contemporaneous response of credit to real sector to shocks from maximum lending rate. Among other things, lending rate determines the quantity of credit banks give to their customers. c_{76} represents contemporaneous response of credit to real sector to shocks from credit risk. A high risk of default brings about higher non-performing loans, which makes banks lower credit to sectoral real sector. c_{89} represents the interest rate are affected by changes in monetary policy rate; this affects credit to sectoral real sector. So, the indirect effect of the official interest rate on credit to the sectoral real sector by the banking system can be traced. c_{21} represents the contemporaneous response of interest rate to shocks from monetary policy rate.

contemporaneous response of broad money supply to sectoral real output. As real output increases, all things being equal, more money will be needed to purchase more goods and services, as a result of the increase in output. c_{91} represents the contemporaneous response of sectoral real output to shocks from monetary policy rate. Real output responds to changes in monetary policy rate, through short term interest rates and other monetary policy channels. c_{92} represents the contemporaneous response of sectoral real output to shocks from interest rate. This follows is-lm framework, where changes in interest rate will affect sectoral real output through investment. c_{93} represents the contemporaneous response of sectoral real output to shocks from exchange rate. This follows exchange rate channel of monetary policy impulses. c_{94} represents the contemporaneous response of sectoral real output to shocks from asset price. When stock prices fall, the value of financial wealth decreases which leads to a reduction in consumption and sectoral real output. c_{95} represents the contemporaneous response of sectoral real output to shocks from maximum lending rate. As banks lend to each subsector of the real sector, more investments are made, leading to an increase in real output. c_{97} represents the contemporaneous response of real output to shocks from credit to real sector. Through investment, a rise in credit to real sector will increase output. c_{98} represents the contemporaneous response of sectoral real output to broad money supply. An increase in broad money supply will shift the LM curve to the right, while a decrease in broad money supply will shift the LM curve to the left. In all this, sectoral real output is affected

Results and Discussions

Diagnostic Test

Philip Perron Unit Root Test

Table 4A: Summary of Unit Root Test

		Level			1st Difference	
Variables	**Observed Values**	**Critical Values**	**Remark**	**Observed Values**	**Critical Values**	**Remark**
lmpr_d11	-1.22240	-2.9314	Non-Stationary	-3.73633	-2.93316	Stationary
lir_d11	-2.21950	-2.9314	Non-Stationary	-5.63109	-2.93316	Stationary
lner_d11	-0.485020	-2.931404	Non-Stationary	-5.744341	-2.933158	Stationary
lPe_d11	-3.05610	-2.9314	Stationary	-4.26058	-2.93316	Stationary
lmlr_d11	-2.050623	-2.9314	Non-Stationary	-3.274569	-2.933158	Stationary
lcr_d11	-2.049962	-2.9314	Non-Stationary	-6.8011	-2.933158	Stationary
lrsc_d11	-3.109756	-2.93316	Stationary	-7.981767	-2.935001	Stationary
lcrs_d11	-2.708386	-2.931404	Non-Stationary	-4.123297	-2.933158	Stationary
lm2_d11	-3.435938	-2.931404	Stationary	-8.338663	-2.933158	Stationary
lxt_d11	-2.358127	-2.931404	Non-Stationary	-6.173393	-2.933158	Stationary
lxtAgriculture_d11	-2.321881	-2.931404	Non-Stationary	-6.266563	-2.933158	Stationary
lxtManufacturing_d11	-2.733602	-2.931404	Non-Stationary	-6.958154	-2.933158	Stationary
lxtConstruction_d11	-2.218326	-2.931404	Non-Stationary	-6.053167	-2.933158	Stationary
lxtServices_d11	-2.194604	-2.931404	Non-Stationary	-8.017515	-2.933158	Stationary
lxtTrade_d11	-2.289955	-2.931404	Non-Stationary	-5.874362	-2.933158	Stationary

The stationarity test was conducted, using Phillips Perron unit root tests. At first difference, all the variables were stationary as detailed in table 4.A.

Lag Selection Criteria

Akaike information criterion (AIC), Final Prediction Error (FPE) Hannan-Quinn information criterion (HQ) and Schwartz information criterion (SC) information criteria were used to determine the lag length. The choice of the optimum lag length used for this study is the lag which most criteria consider to be the optimum. This is indicated with an asterisk (*) in figure 4A.

VAR Lag Order Selection Criteria
Endogenous variables: DLOG(MPR_D11) DLOG(R_D11) DLOG(NER_D11) LOG(PA_D11) DLOG(MLR_D11) DLOG(CR_D11) DLOG(CRS_D11) DLOG(M2_D11) DLOG(XTAGRICULTURE_D11)
Exogenous variables: C
Date: 08/27/20 Time: 14:07
Sample: 2008Q1 2018Q4
Included observations: 40

Lag	LogL	LR	FPE	AIC	SC	HQ
0	352.0441	NA	2.88e-19	-17.15220	-16.77221*	-17.01481
1	448.5355	144.7371	1.46e-19	-17.92678	-14.12680	-16.55282
2	563.1941	120.3915*	5.20e-20	-19.60971	-12.38975	-16.99920
3	710.0049	88.08648	1.86e-20*	-22.90025*	-12.26030	-19.05318*

Figure 4A - Lag Selection Criteria

Ebenezer O. OLADIMEJI, Ebenezer BOWALE and Henry OKODUA, Journal of African Research in Business & Technology, DOI: 10.5171/2022.764416

Stability and Normality Test

The reduced form VARs are stable as detailed in figure 4B; all the roots have modulus less than one and lie inside the unit circle. The normality test results in table 4B satisfy the normality condition, as the probability value corresponding to the Jarque-Bera statistics is more than 5%; meaning that residuals are multivariate normal.

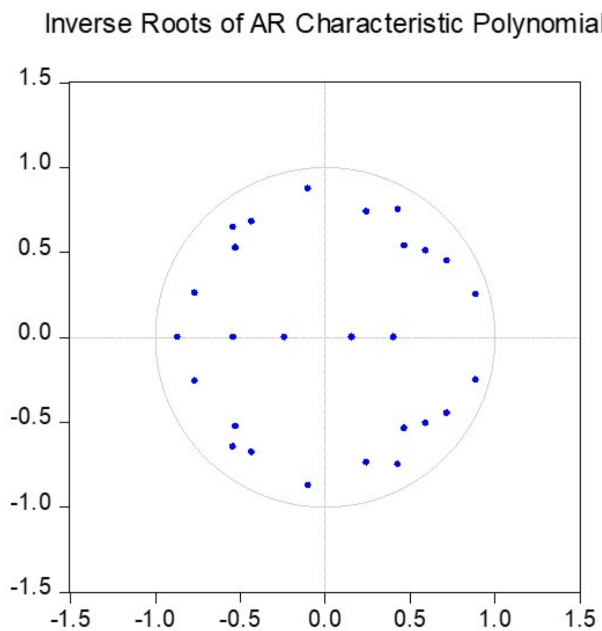

Figure 4B - Stability Condition Table

Table 4B - Normality Test

Summary of Normality Test Result

Component	Jarque-Bera	df	Prob.
1	1.118162	2	0.5717
2	2.189708	2	0.3346
3	0.251558	2	0.8818
4	13.11685	2	0.0014
5	1.249456	2	0.5354
6	2.014708	2	0.3652
7	4.916579	2	0.0856
8	0.365119	2	0.8331
9	0.194590	2	0.9073
Joint	25.41673	18	0.1139

*Approximate p-values do not account for coefficient estimation

Discussion of Results

Summary of SVAR Estimate of Contemporaneous Response among Variables

Agriculture

Table 4C - Summary of Agriculture SVAR Result

mpr_t	r_t	ner_t	P_{at}	mlr_t	cr_t	crs_t	$m2_t$	$x_{t\,Agriculture}$	
1	0.807814 (0.1972)	0	0	0	0	-25.53942 (0.0000)**	0	0	mpr_t
8.667396 (0.0013)**	1	-21.74130 (0.0000)**	0	0	0	0	0	-1.378334 (0.0009)**	r_t
0	3.824141 (0.0000)**	1	0	0	0	0	0	0	ner_t
0	0	0	1	0	0	0	0	0	P_{at}
0	0	0	0	1	0	0	0	2.414670 (0.0000)**	mlr_t
0	0	0	0	50.47728 (0.0000)**	1	0	0	0	cr_t
0	2.236880 (0.0073)**	0	0	-4.602658 (0.6508)	-10.41415 (0.0000)**	1	0	0	crs_t
0	0	0	0	0	0	0	1	0.020702 (0.9568)	$m2_t$
18.63747 (0.0000)**	-1.246036 (0.2559)	3.483920 (0.5144)	3.897115 (0.1606)	-60.64771 (0.0000)**	0.078765 (0.9693)	22.52068 (0.0001)**	3.03625 (0.6409)	1	$x_{t\,Agriculture}$

*Note: ** indicates significant at 5% level, while * indicates significant at 10%*
Source: Author's computation using Eviews 10

Table 4C is the SVAR result estimates of agricultural sector, including the intervening role of credit risk. It reveals the contemporaneous response of each variable to shocks from other variables in the system. For instance, the estimate of contemporaneous response of credit to real sector to shocks from credit risk is -10.41415; which indicates a reduction in credit/funds to the real sector during the period of high credit risk.

Manufacturing

Table 4D - Summary of Manufacturing SVAR Result

mpr_t	r_t	ner_t	P_{at}	mlr_t	cr_t	crs_t	$m2_t$	$x_{t\,Manufacturing}$	
1	0.775307 (0.2134)	0	0	0	0	-22.24474 (0.0000)**	0	0	mpr_t
-12.45672 (0.0000)**	1	25.81521 (0.0000)**	0	0	0	0	0	1.745872 (0.0000)**	r_t
0	3.876809 (0.0000)**	1	0	0	0	0	0	0	ner_t
0	0	0	1	0	0	0	0	0	P_{at}
0	0	0	0	1	0	0	0	1.916532 (0.0000)**	mlr_t
0	0	0	0	53.51817 (0.0000)**	1	0	0	0	cr_t
0	2.620936 (0.0027)**	0	0	-12.16249 (0.2763)	-11.67059 (0.0000)**	1	0	0	crs_t
0	0	0	0	0	0	0	1	0.022539 (0.9407)	$m2_t$
-30.10578 (0.0000)**	-0.983827 (0.4513)	1.527279 (0.6764)	-3.46359 (0.0992)*	133.6996 (0.0000)**	-3.743595 (0.0920)*	-20.90326 (0.0001)**	21.80962 (0.0018)**	1	$x_{t\,Manufacturing}$

*Note: ** indicates significant at 5% level, while * indicates significant at 10%*
Source: Author's computation using Eviews 10

Table 4D is the SVAR result estimates of manufacturing sector, including the intervening role of credit risk. It shows the contemporaneous response of each variable to shocks from other variables in the system. The estimate of contemporaneous response of credit to real sector to shocks from credit risk is -11.67059, which suggests a reduction in credit/funds to the real sector during the period of high credit risk.

Construction

Table 4E - Summary of Construction SVAR Result

mpr_t	r_t	ner_t	P_{at}	mlr_t	cr_t	crs_t	$m2_t$	$x_{t\,Construction}$	
1	0.761145 (0.2246)	0	0	0	0	-26.1694 (0.0000)	0	0	mpr_t
10.18958 (0.0003)**	1	-22.6245 (0.0000)**	0	0	0	0	0	-1.148720 (0.0002)**	r_t
0	3.837006 (0.0000)**	1	0	0	0	0	0	0	ner_t
0	0	0	1	0	0	0	0	0	P_{at}
0	0	0	0	1	0	0	0	1.817059 (0.0000)**	mlr_t
0	0	0	0	50.97136 (0.0000)**	1	0	0	0	cr_t
0	2.239285 (0.0070)**	0	0	-2.803873 (0.7835)	-10.50587 (0.0000)**	1	0	0	crs_t
0	0	0	0	0	0	0	1	0.013567 (0.9624)	$m2_t$
16.66220 (0.0000)**	-0.800971 (0.4585)	4.881293 (0.4039)	4.826338 (0.1011)	-59.43080 (0.0000)**	-0.900672 (0.6632)	19.79595 (0.0004)**	4.259970 (0.5058)	1	$x_{t\,Construction}$

*Note: ** indicates significant at 5% level, while * indicates significant at 10%*
Source: Author's computation using Eviews 10

Table 4E is the SVAR result estimates of construction sector, including the intervening role of credit risk. The contemporaneous response of each variable to shocks from other variables in the system is summarized in the table. Among these is the estimate of contemporaneous response of credit to real sector to shocks from credit risk, which is -10.50587. This indicates that credit to construction sector is reduced during the period of high credit risk.

Services

Table 4F - Summary of Services SVAR Result

mpr_t	r_t	ner_t	P_{at}	mlr_t	cr_t	crs_t	$m2_t$	$x_{t\,Services}$	
1	0.917968 (0.1449)	0	0	0	0	-26.44036 (0.0000)**	0	0	mpr_t
7.106868 (0.0208)**	1	-23.23992 (0.0000)**	0	0	0	0	0	-1.320489 (0.0001)**	r_t
0	3.830269 (0.0000)**	1	0	0	0	0	0	0	ner_t
0	0	0	1	0	0	0	0	0	P_{at}
0	0	0	0	1	0	0	0	1.853437 (0.0000)**	mlr_t
0	0	0	0	50.75424 (0.0000)**	1	0	0	0	cr_t
0	2.733136 (0.0013)**	0	0	-7.691333 (0.4525)	-11.76111 (0.0000)**	1	0	0	crs_t
0	0	0	0	0	0	0	1	0.016881 (0.9541)	$m2_t$
22.24043 (0.0000)**	-0.460217 (0.7056)	-6.530321 (0.2769)	9.756428 (0.0002)**	-54.70014 (0.0001)**	-3.04040 (0.2515)	19.58511 (0.0011)**	12.88914 (0.0746)*	1	$x_{t\,Services}$

*Note: ** indicates significant at 5% level, while * indicates significant at 10%*
Source: Author's computation using Eviews 10

The credit to the service sector, as revealed in table 4F, is also affected by high credit risk. This is evidenced by estimate of the contemporaneous response of credit to real sector to shocks from credit risk, which is -11.76111.

Trade

Table 4G - Summary of Trade SVAR Result

mpr_t	r_t	ner_t	P_{at}	mlr_t	cr_t	crs_t	$m2_t$	$x_{t\,Trade}$	
1	0.761656 (0.2239)	0	0	0	0	-26.39257 (0.0000)**	0	0	mpr_t
9.085958 (0.0006)**	1	-22.31715 (0.0000)**	0	0	0	0	0	-1.311654 (0.0007)**	r_t
0	3.831586 (0.0000)**	1	0	0	0	0	0	0	ner_t
0	0	0	1	0	0	0	0	0	P_{at}
0	0	0	0	1	0	0	0	2.223972 (0.0000)**	mlr_t
0	0	0	0	50.92264 (0.0000)**	1	0	0	0	cr_t
0	2.415104 (0.0040)**	0	0	-6.076414 (0.5525)	-10.72500 (0.0000)**	1	0	0	crs_t
0	0	0	0	0	0	0	1	0.017603 (0.9602)	$m2_t$
17.81040 (0.0000)**	-1.305675 (0.2468)	5.194265 (0.3427)	3.694689 (0.1718)	-57.42246 (0.0000)**	0.003862 (0.9985)	22.60778 (0.0001)**	2.693273 (0.6648)	1	$x_{t\,Trade}$

*Note: ** indicates significant at 5% level, while * indicates significant at 10%*
Source: Author's computation using Eviews 10

Table 4G is the SVAR result estimates of trade sector. With the intervening role of credit risk, the credit to the sector from the banking system is reduced. This further explains the estimate of -10.72500, which is significant at 5%.

Forecast Error Variance Decomposition

Agriculture

Table 4H - Variance Decomposition of Agricultural Output with the Intervening Role of Credit Risk

Variance Decomposition of DLOG(XTAGRICULTURE_D11):		mpr	r	ner	P_{at}	mlr	cr	crs	m2	XtAgriculture
Period	S.E.	Shock1	Shock2	Shock3	Shock4	Shock5	Shock6	Shock7	Shock8	Shock9
1	0.414234	8.27E-07	2.39E-07	0.000126	4.83E-07	99.95949	0.040014	0.000369	2.93E-07	3.18E-08
2	2.571412	0.236076	0.225899	0.003408	94.25380	2.657708	0.009971	0.309417	2.079425	0.224297
3	3.428155	0.968383	0.233606	0.286517	53.43521	1.787862	0.448448	0.176929	42.14681	0.516237
4	3.624916	0.867775	0.213871	0.273724	51.05862	1.851112	0.732843	0.160247	44.36396	0.477853
5	4.214148	0.662515	0.246428	0.237280	53.46791	1.403418	0.542335	0.196787	42.88194	0.361388
6	4.260932	0.648219	0.291015	0.435975	52.41585	1.580179	1.223422	0.227001	42.82480	0.353542
7	4.825133	0.507325	0.231062	0.366782	41.23090	1.234602	0.956099	0.178177	55.01934	0.275713
8	5.028670	0.467461	0.212841	0.368732	38.67211	1.142707	0.882283	0.186558	57.81338	0.253929
9	5.075561	0.462342	0.208959	0.473374	38.83538	1.121757	0.892576	0.183236	57.56612	0.256259
10	5.145285	0.450566	0.203367	0.490105	40.32483	1.093639	0.881034	0.181362	56.11214	0.262958
Average		0.527066	0.206704	0.293602	46.36946	11.383247	0.6609025	0.180083	40.08079	0.298217

Factorization: Structural

Table 4H shows the variation in agricultural output as a result of shocks from other variables in the system. With the intervening role of credit risk, the contributions of shocks from the interest rate, exchange rate, asset price, and money supply are respectively 0.20%, 0.29%, 46.36% and 40.08%.

Table 4Ha - Variance Decomposition of Agricultural Output without the Intervening Role of Credit Risk

Variance Decomposition of DLOG(XTAGRICULTURE_D11):		mpr	r	ner	P_{at}	mlr	crs	m2	XtAgriculture
Period	S.E.	Shock1	Shock2	Shock3	Shock4	Shock5	Shock6	Shock7	Shock8
1	0.396084	4.76E-05	1.48E-05	0.011666	7.34E-06	99.96122	0.027022	8.45E-06	1.11E-05
2	3.022165	0.292404	0.269692	0.011975	68.51626	1.718712	0.038259	29.05621	0.096487
3	3.226604	1.013560	0.634864	0.059425	60.78241	1.688947	0.308650	35.11222	0.399925
4	3.612766	0.889956	0.510264	0.107780	47.30751	1.368227	0.409279	49.06453	0.342459
5	4.068184	0.724676	0.449021	0.115376	50.25024	1.094645	0.345020	46.72781	0.293215
6	4.197416	0.684569	0.450304	0.108676	49.45172	1.176228	0.698696	47.15191	0.277896
7	4.832588	0.517487	0.339731	0.108366	37.30675	0.887726	0.531176	60.09874	0.210022
8	4.840401	0.515865	0.340902	0.119338	37.19003	0.884890	0.532136	60.20686	0.209987
9	4.911091	0.501569	0.331227	0.132485	36.22279	0.861589	0.520401	61.22499	0.204947
10	4.985484	0.488019	0.321843	0.134401	38.04875	0.837297	0.505055	59.46348	0.201154
Average		0.562815	0.364786	0.090949	42.50765	11.04795	0.391569	44.81068	0.223610
Factorization: Structural									

In table 4Ha, it is evidently seen that shocks from the interest rate, exchange rate, asset price, and money supply caused variations in agricultural output. These variations are respectively 0.36%, 0.09%, 42.50% and 44.81%.

Manufacturing

Table 4I - Variance Decomposition of Manufacturing Output with the Intervening Role of Credit Risk

Variance Decomposition of DLOG(XTMANUFACTURING_D11):		mpr	r	ner	P_{at}	mlr	cr	crs	m2	XtManufacturing
Period	S.E.	Shock1	Shock2	Shock3	Shock4	Shock5	Shock6	Shock7	Shock8	Shock9
1	0.521891	7.85E-07	2.04E-07	0.000131	2.98E-07	99.96313	0.036459	0.000269	1.18E-05	2.48E-08
2	4.624366	0.036855	0.001611	0.021301	41.87582	1.273595	0.005009	0.015822	56.70047	0.069516
3	7.601565	0.178733	0.015357	0.279055	15.64460	0.642356	0.322400	0.042026	82.77850	0.096974
4	8.525395	0.143905	0.025083	0.221919	42.93533	0.609994	0.317372	0.045993	55.62215	0.078250
5	9.275999	0.123723	0.034000	0.216919	40.01933	0.515294	0.319982	0.046061	58.65537	0.069327
6	9.405383	0.121120	0.040036	0.211214	30.23606	0.519217	0.367698	0.060470	68.37398	0.070205
7	10.45406	0.106214	0.046852	0.238097	26.66869	0.425972	0.298189	0.075800	72.08111	0.059074
8	11.08523	0.095295	0.042706	0.212257	25.79065	0.378845	0.266656	0.067682	73.09281	0.053095
9	11.19894	0.093376	0.042601	0.222711	26.72786	0.371247	0.262963	0.074455	72.15269	0.052096
10	11.30362	0.091690	0.042628	0.233473	26.46654	0.364822	0.266411	0.077039	72.40331	0.054085
Average		0.099091	0.029087	0.185708	27.63649	10.50645	0.246314	0.050562	61.18604	0.060262
Factorization: Structural										

In table 4I, the respective contributions of shocks to interest rate, exchange rate, asset price and money supply, to the changes in manufacturing output are 0.02%, 0.18%, 27.63% and 61.18%. This is with the intervening role of credit risk

Table 4Ia - Variance Decomposition of Manufacturing Output without the Intervening Role of Credit Risk

Variance Decomposition of DLOG(XTMANUFACTURING_D11): Period	S.E.	mpr Shock1	r Shock2	ner Shock3	P_{at} Shock4	mlr Shock5	crs Shock6	m2 Shock7	XtManufacturing Shock8
1	0.476312	6.88E-05	1.33E-05	0.013625	1.63E-05	99.96149	0.024681	0.000100	9.71E-06
2	3.093763	0.126861	0.107156	0.003712	94.51662	2.371434	0.080173	2.564129	0.229918
3	4.448170	0.574618	0.092534	0.021231	36.61190	1.368378	0.401164	60.52117	0.409014
4	7.155861	0.223007	0.060032	0.024242	19.01148	0.580611	0.184279	79.75682	0.159534
5	8.246059	0.172872	0.050414	0.021562	21.62869	0.438856	0.187719	77.37367	0.126219
6	8.314269	0.176327	0.049721	0.042776	11.29960	0.434870	0.226147	87.63813	0.132428
7	9.182479	0.153093	0.041259	0.060750	17.58179	0.358971	0.185957	81.50368	0.114496
8	9.473405	0.146553	0.038873	0.057686	17.08197	0.343358	0.177535	82.04642	0.107604
9	9.520865	0.145456	0.039016	0.059714	17.89224	0.345314	0.179688	81.23149	0.107081
10	9.527642	0.148394	0.039484	0.064661	17.87908	0.344943	0.179438	81.23300	0.111001
Average		0.186725	0.05185	0.036996	25.35034	10.65482	0.182678	63.38686	0.149730

Factorization: Structural

Table 4Ia contains the percentage variation to manufacturing output as a result of shocks to variables such as interest rate, exchange rate, asset price, and money supply. The contributions to variations in manufacturing output are 0.05%, 0.03%, 25.35% and 63.38%.

Construction

Table 4J -Variance Decomposition of Construction Output with the intervening role of Credit Risk

Variance Decomposition of DLOG(XTCONSTRUCTION_D11): Period	S.E.	mpr Shock1	r Shock2	ner Shock3	P_{at} Shock4	mlr Shock5	cr Shock6	crs Shock7	m2 Shock8	XtConstruction Shock9
1	0.550470	7.75E-07	1.92E-07	0.000120	1.08E-06	99.96054	0.038980	0.000352	8.41E-07	4.64E-08
2	3.288498	0.122460	0.310248	0.001469	95.42775	2.902223	0.028974	0.437538	0.626631	0.142710
3	5.073596	0.466013	0.240684	0.174135	61.77898	1.350619	0.236877	0.186313	35.30588	0.260500
4	5.193193	0.448739	0.231605	0.186813	51.92348	1.506332	0.560459	0.186359	44.66944	0.286779
5	5.926495	0.359885	0.250136	0.177306	41.52013	1.191446	0.430798	0.188521	55.65585	0.225928
6	5.998622	0.351478	0.299999	0.385372	41.42308	1.379157	1.096159	0.213194	54.62798	0.223577
7	6.642121	0.286678	0.247423	0.349510	44.10572	1.124993	0.894557	0.173889	52.63477	0.182462
8	6.774947	0.276592	0.237874	0.367650	43.15164	1.085713	0.860341	0.182772	53.66171	0.175709
9	6.830935	0.272951	0.234586	0.487515	42.94796	1.069613	0.885728	0.181517	53.74209	0.178049
10	6.907021	0.266981	0.229451	0.506251	43.98869	1.051609	0.875335	0.180623	52.71955	0.181510
Average		0.285178	0.228201	0.263614	46.62674	11.26222	0.590821	0.193108	40.36439	0.185722

Factorization: Structural

In table 4J, the variation to construction output with the intervening role of credit risk is shown. According to the result, about 0.22% variation in construction output is due to shocks from the interest rate. Shocks to exchange rate account for 0.26% variation in the output; shocks to asset price account for 46.62% variation in the output, while shocks to money supply account for 40.36% variation in construction output.

Table 4Ja -Variance Decomposition of Construction Output without the Intervening Role of Credit Risk

Variance Decomposition of DLOG(XTCONSTRUCTION_D11):		mpr	r	ner	P_{at}	mlr	crs	m2	XtConstruction
Period	S.E.	Shock1	Shock2	Shock3	Shock4	Shock5	Shock6	Shock7	Shock8
1	0.538245	4.77E-05	8.46E-06	0.011129	5.62E-05	99.96261	0.026067	6.98E-05	1.37E-05
2	3.965667	0.193635	0.238450	0.028733	82.82686	1.847890	0.083925	14.74271	0.037798
3	4.698929	0.534731	0.488347	0.080810	58.99393	1.417714	0.185232	38.13100	0.168241
4	4.927114	0.573440	0.444165	0.121645	53.83627	1.307493	0.338177	43.18958	0.189228
5	5.707411	0.444871	0.355638	0.124417	42.96235	0.989890	0.273301	54.68656	0.162973
6	5.878808	0.426865	0.373795	0.118332	43.64425	1.064369	0.588157	53.63062	0.153612
7	6.669492	0.331692	0.290471	0.110793	33.91174	0.828893	0.457428	63.94938	0.119597
8	6.671598	0.331484	0.291671	0.122766	33.89108	0.828478	0.458015	63.95698	0.119522
9	6.753433	0.323518	0.284764	0.135807	33.10310	0.811621	0.448845	64.77568	0.116667
10	6.822557	0.319653	0.279313	0.141901	34.42950	0.795268	0.439814	63.47924	0.115306
Average		0.347994	0.304662	0.099633	41.75991	10.98542	0.329896	46.05418	0.118296

Factorization: Structural

Without the intervening role of credit risk as revealed in table 4Ja, shocks to the interest rate are responsible for 0.30% variation in construction output. Shocks to exchange rate, asset price and money supply respectively account for about 0.09%, 41.75%, and 46.05 variation in construction output.

Services

Table 4K - Variance Decomposition of Services Output with the Intervening Role of Credit Risk

Variance Decomposition of DLOG(XTSERVICES_D11):		mpr	r	ner	P_{at}	mlr	cr	crs	m2	XtServices
Period	S.E.	Shock1	Shock2	Shock3	Shock4	Shock5	Shock6	Shock7	Shock8	Shock9
1	0.539672	5.61E-07	3.16E-07	0.000147	2.03E-06	99.95967	0.039885	0.000287	3.54E-06	2.13E-08
2	5.356478	0.092312	0.057554	0.005903	58.2503	1.182468	0.000690	0.161596	40.14126	0.107916
3	10.29285	0.186617	0.033367	0.074830	31.09101	0.327086	0.180302	0.052169	67.94138	0.113241
4	10.32438	0.185501	0.052437	0.074758	31.03623	0.331674	0.187847	0.052742	67.96558	0.113239
5	10.45144	0.181463	0.087796	0.099091	32.33851	0.324368	0.186456	0.062884	66.60892	0.110513
6	10.48435	0.180867	0.105498	0.227286	32.32897	0.358843	0.387945	0.070629	66.22999	0.109977
7	10.89121	0.170436	0.102955	0.211689	30.75330	0.342647	0.370132	0.071280	67.87516	0.102397
8	11.08786	0.165206	0.099765	0.240142	30.13620	0.330602	0.361962	0.074236	68.49301	0.098885
9	11.11572	0.165001	0.099269	0.309496	30.41920	0.331522	0.376422	0.074030	68.12434	0.100718
10	11.18468	0.163035	0.098133	0.351232	30.26293	0.343598	0.381657	0.078411	68.21395	0.107053
Average		0.149044	0.073677	0.159457	30.66167	10.38325	0.247330	0.069826	58.15936	0.096394

Factorization: Structural

The result from table 4K reveals the percentage variation in services real output to shocks from the interest rate, exchange rate, asset price, and money supply, which are 0.07%, 0.15%, 30.66, and 58.15%.

Table 4Ka - Variance Decomposition of Services Output without the Intervening Role of Credit Risk

Variance Decomposition of DLOG(XTSERVICES_D11): Period	S.E.	mpr Shock1	r Shock2	ner Shock3	P_{at} Shock4	mlr Shock5	crs Shock6	m2 Shock7	XtServices Shock8
1	0.536895	3.25E-05	1.24E-05	0.011951	0.000141	99.96021	0.027120	0.000525	1.24E-05
2	5.110014	0.116541	0.185040	0.003633	51.32144	1.203458	0.009208	47.10664	0.054044
3	7.470209	0.266057	0.303002	0.013955	24.85758	0.576131	0.210594	73.66036	0.112318
4	7.509223	0.287906	0.323537	0.046787	25.14837	0.576626	0.227918	73.26612	0.122734
5	7.632149	0.281127	0.354428	0.095585	25.21357	0.560616	0.229980	73.13597	0.128717
6	7.695602	0.276518	0.374925	0.117809	25.46270	0.605966	0.405133	72.62416	0.132784
7	8.535631	0.225026	0.311929	0.096607	20.80832	0.492574	0.334837	77.62273	0.107983
8	8.545148	0.224525	0.311237	0.111650	20.89473	0.497810	0.345053	77.50654	0.108448
9	8.593255	0.222243	0.309556	0.132886	20.67763	0.495183	0.353867	77.70131	0.107321
10	8.667662	0.218632	0.308379	0.152661	21.05042	0.489553	0.352052	77.31952	0.108788
Average		0.211861	0.278205	0.078352	23.54349	10.54581	0.249576	64.99439	0.098315

Factorization: Structural

Table 4Ka reveals the contributions of shocks to interest rate, exchange rate, asset price, and money supply to the percentage variation in services real output, without the intervening role of credit risk. These variations are respectively 0.27%, 0.07%, 23.54% and 64.99%.

Trade

Table 4L: Variance Decomposition of Trade Output with the Intervening Role of Credit Risk

Variance Decomposition of DLOG(XTTRADE_D11): Period	S.E.	mpr Shock1	r Shock2	ner Shock3	P_{at} Shock4	mlr Shock5	cr Shock6	crs Shock7	m2 Shock8	XtTrade Shock9
1	0.449752	7.55E-07	2.28E-07	0.000136	5.18E-07	99.96001	0.039509	0.000343	2.75E-07	3.79E-08
2	2.779049	0.162744	0.320438	0.028290	92.84985	2.661659	0.066739	0.342830	3.397769	0.169683
3	3.808638	0.739472	0.344337	0.295589	49.85203	1.604093	0.443938	0.183213	46.14643	0.390895
4	3.971258	0.691570	0.319899	0.275953	48.53565	1.625294	0.649582	0.168679	47.34921	0.384165
5	4.442105	0.576546	0.338919	0.260940	49.79195	1.338551	0.519422	0.207301	46.65473	0.311638
6	4.543776	0.551033	0.369626	0.464723	48.48815	1.446439	1.213702	0.218751	46.94958	0.297997
7	5.209245	0.420975	0.283793	0.389232	37.06904	1.100532	0.923492	0.166437	59.41977	0.226730
8	5.339192	0.401234	0.270383	0.414151	35.77427	1.051118	0.879984	0.175447	60.81756	0.215846
9	5.410553	0.392429	0.263298	0.534363	35.21273	1.024130	0.888736	0.171595	61.29615	0.216575
10	5.497450	0.380128	0.255041	0.546700	36.93104	0.994723	0.866824	0.169517	59.63675	0.219275
Average		0.431613	0.276573	0.321008	43.45047	11.28065	0.649193	0.180411	43.16679	0.243280

Factorization: Structural

The trade variance decomposition result with the intervening role of credit risk is detailed in table 4L. While trade output variation of 0.27% is caused by shocks to interest rate, other variations of 0.32%, 43.45%, and 43.16% are as a result of shocks to exchange rate, asset price, and money supply.

Table 4La: Variance Decomposition of Trade Output without the Intervening Role of Credit Risk

Variance Decomposition of DLOG(XTMANUFACTURING_D11): Period	S.E.	mpr Shock1	r Shock2	ner Shock3	P_{at} Shock4	mlr Shock5	crs Shock6	m2 Shock7	XtManufacturing Shock8
1	0.476312	6.88E-05	1.33E-05	0.013625	1.63E-05	99.96149	0.024681	0.000100	9.71E-06
2	3.093763	0.126861	0.107156	0.003712	94.51662	2.371434	0.080173	2.564129	0.229918
3	4.448170	0.574618	0.092534	0.021231	36.61190	1.368378	0.401164	60.52117	0.409014
4	7.155861	0.223007	0.060032	0.024242	19.01148	0.580611	0.184279	79.75682	0.159534
5	8.246059	0.172872	0.050414	0.021562	21.62869	0.438856	0.187719	77.37367	0.126219
6	8.314269	0.176327	0.049721	0.042776	11.29960	0.434870	0.226147	87.63813	0.132428
7	9.182479	0.153093	0.041259	0.060750	17.58179	0.358971	0.185957	81.50368	0.114496
8	9.473405	0.146553	0.038873	0.057686	17.08197	0.343358	0.177535	82.04642	0.107604
9	9.520865	0.145456	0.039016	0.059714	17.89224	0.345314	0.179688	81.23149	0.107081
10	9.527642	0.148394	0.039484	0.064661	17.87908	0.344943	0.179438	81.23300	0.111001
Average		0.186725	0.05185	0.036996	25.35034	10.65482	0.182678	63.38686	0.149730

Factorization: Structural

In table 4La, the variations of trade real output as a result of shocks to interest rate, exchange rate, asset price, and money supply are respectively 0.51, 0.07%, 40.34%, and 45.94%.

As shown in the sectoral SVAR result estimates in tables 4C, 4D, 4E, 4F and 4G, the interaction among the variables in the model follows the theoretical justifications that underscore the identification process. Most of the estimates are statistically significant at 5% level, including the contemporaneous response of credit to real sector to shocks to credit risk. With the role of credit risk in the relationship between monetary policy and the real sector, it is expected that in the period of high credit risk, less credit will be channelled or transmitted from the banking system to the real sector. This will eventually lead to a reduced impact on the real sector, as the effectiveness of the transmission chain is reduced by the intervening role of the credit risk. This is exactly the case, as shown in tables 4.H, 4.I, 4.J, 4.K and 4.L. These tables detail the channels through which the sectoral real outputs are affected or impacted, as a result of monetary policy actions of the CBN, with consideration for credit risk. When compared with the results in tables 4.Ha, 4.Ia, 4.Ja, 4.Ka and 4.La, it is evident that without the intervening role of credit risk, more money flows to the real sector through the money supply, which represents the credit channel, because money supply increases majorly as banks create more money through credit/deposit expansion.

For instance, without the intervening role of credit risk, about an average of 42.50% and 44.81% variation or changes to agricultural output are respectively from asset price and credit channels. With the intervening role of credit risk, the monetary policy effects on the agricultural output, through the credit channel, are reduced to 40.08%, which means that during the period of high credit risk, the monetary policy effects on agricultural subsector are majorly through the asset price channel (46.36%). For the manufacturing subsector, the monetary policy effect is majorly through the credit channel, both with and without the intervening role of credit risk. However, the effect is greater without the intervening role of credit risk (63.38%) than when the intervening role of credit risk is considered (61.18%). For the construction subsector, the effects of monetary policy during the period of high credit risk are majorly through asset price channel (46.62%), while the monetary policy effect on the subsector is majorly through the credit channel, without the intervening role of credit risk (46.05%). Similar evidence is established in the trade subsector, where an average of 43.45% changes to trade output is through the asset price channel in a period of high credit risk and 45.94% variation in the said subsector is through the credit channel, without the intervening role of credit risk. However, the credit channel in the services subsector is the major channel, both with and without the intervening role of credit risk; but the effect is lesser during the period of high credit risk. Further findings revealed that the interest and exchange rate channels are very weak in transmitting monetary policy effects to all the subsectors, as the changes to the sectoral real outputs are insignificant.

Comparing this study's results with the result of the study carried out by the Central Bank of Nigeria (CBN, 2014), the following analysis can be arrived at: The

CBN established that (a) There is evidence of heterogeneous response of sectoral output to contractionary monetary policy shock. (b) As revealed by the forecast error variance decomposition, the most important variable that explains the variation in the subsectors is money supply, which represents the credit channel. (c) The variations in sectoral real output are not significantly explained by monetary policy rate and exchange rate. This above analysis is similar to the findings of this study, without the intervening role of credit risk. The monetary policy, interest, and exchange rates' contributions to the variations in sectoral outputs are insignificant. The variation to real output is majorly explained by money supply (which represents the credit channel) and asset price variables. However, the result is different, with the intervening role of credit risk. The asset price channel is the most effective in the agricultural, construction, and trade subsectors, during the period of high credit risk; while the effect of credit channel is reduced, in the manufacturing and services subsectors, with the intervening role of credit risk. This is one of the major contributions of this study.

Conclusion

The real sector in Nigeria has been given some level of attention in the past few years. This is a deliberate action to improve the sector and reduce overdependence on oil. This policy action includes influencing the banking system to channel more funds to the sector, through the use of monetary policy instruments. This study reexamined the sectoral effects of this process, using SVAR econometric technique with seasonally adjusted quarterly data spanning from 2008Q1 to 2018Q4. The results showed that monetary policy significantly impacts on the sectoral real sector. The credit and asset price channels are the two major channels of transmitting monetary policy effects to the agricultural, manufacturing, construction, services and trade subsectors. However, in the period of high credit risk, the credit channel transmits lesser monetary policy effects to the real sector than the asset price channel.

Recommendation

Evidence from the research findings revealed that all the subsectors of the real sector respond differently to the monetary policy actions of the Central Bank of Nigeria. Therefore, this study recommends that the monetary authority should always consider each subsector separately, by disaggregating the policy objectives to achieve the desired goals.

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