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Research Paper

Credit Supply Shocks and Macroeconomics Dynamics in Nigeria

Mr. IGWE Lazarus Onyebuchi
lazarusigwe@rocketmail.com. Economics Department, Michael Okpara University Umudike.

Prof. Barr. C. U Ugwuanyi.
Ugwuanyi.charles@mouau.edu.ng. same address

Abstract: *The impact of credit supply shocks on macroeconomic dynamics have generated a lot of interest among macroeconomist over the years. This study investigates the response of real gross domestic product, monetary policy rate and consumer price index to shocks in credit supply in Nigeria. Quarterly data ranging from 1984 to 2022 was employed to estimate the specified model. An unrestricted VAR model was employed to capture the objectives of the study and the resulting impulse response was calibrated. Evidence from the impulse response indicate that shocks to credit supply negatively affects real GDP in Nigeria when observed across 10 quarters. It however, leads to positive changes in the consumer price index in the same time period. On the other hand we observe that monetary policy rate reacts positively to shocks in credit supply.*

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I. Introduction

The Global Financial Crisis (GFC) of 2007-2009 has continued to generate interest within the scholars and policy makers on the linkages and feedback effect in the relationship between the financial sector and the real economy, otherwise known as the macro-financial linkages (Volk, 2023). The economic downturn experienced during the crisis brought to bear the inherent interconnection between volatilities in the financial market and the real economy, and in specific terms, the fact that financial and credit market conditions could be a transmission mechanism for economic shocks and/or a significant driver (source) of macroeconomic fluctuations. Since financial markets are capable of amplifying macroeconomic volatilities and business cycle fluctuations, the current macroeconomic research agenda is centered on identifying the role and importance of financial factors in explaining macroeconomic dynamics in an economy (Tule, Ogundele, and Apinran, 2018).

However, the arguments in the literature have been on the role of credit in explaining macroeconomic fluctuations. Given the importance of the credit channel in the monetary transmission process (Bernanke and Gertler, 2000), changes in the financial innovations and regulations could affect the evolution of financial markets and likewise how monetary policy affects the real economy. More importantly, disturbances in the credit markets may constitute an independent source of economic fluctuations. One of such is the disturbances to the supply of credit by financial intermediaries which emanates from the bank lending process and often independent of the central bank's monetary policy actions. Several factors can lead to exogenous shifts in credit supply. In principle, these broadly includes unexpected changes in the characteristics of the financial sector such as technology, preferences, or regulatory environment (Tamasi and Vilagi, 2011). These factors could induce changes in the risk assessment of banks, which in turn, influences the availability of credit supply. Although, the effect of each factor may be difficult to disentangle and may not be identical, however, the bottom line is that they could all influence credit supply.

Several studies have attempted to identify the impact of credit supply shocks. Most of these studies have used a macro econometric framework in the context of structural vector autoregression (VAR) models to analyze the contribution of credit supply shocks in the Global Financial Crises and other economic crises. The identification of credit supply shocks often involves imposing sign restrictions (sometimes in combination with zero restrictions) on the impulse response functions (IRFs) of selected macroeconomic variables. This identification restrictions are drawn based on Dynamic stochastic general equilibrium (DSGE) models with a banking sector and financial intermediation such as Attah Mensah and Dib (2008). The uniqueness of the sign

restrictions-based approach to structural shock identification is because it precludes the typical recursive restrictions (that is, the Cholesky decomposition approach) on the contemporaneous effects among variables. For instance, credit supply shocks can be identified as a shock that causes an opposite movement between the price and quantity of credit. The advantage of these framework has led to a surge in the number of studies assessing the impact of credit shocks mostly for the advanced economies (Gilchrist, and Zakrajšek 2009; Eckmeier and Ng, 2011; Abildgren, 2012; Barnett and Thomas, 2014; Duchi and Elbourne, 2016; Gambetti and Musso, 2017). The bottom line from these studies suggest that credit supply shocks did account significantly for the slump in economic activities during the GFC.

. Currently, there is burgeoning literature analyzing the impact and contribution of credit supply shocks on the real economy on one hand, and another showing that the effect of monetary policy may be state-dependent on credit market conditions. For a developing economy such as Nigeria, these issues remain largely unexplored. Moreover, an understanding of these issues is crucial for designing appropriate monetary and financial stability policies.

In view of the study's research objectives, the research questions of interest for the study is to evaluate the effect of credit supply shock on output growth, inflation and short-term monetary policy rate?

II. Empirical literature Review

Bijsterbosch and Falagiarda (2015) examined the macroeconomic impact of financial fragmentation in the Euro area by evaluating the role of credit supply shocks during the pre-GFC, bust, and post-crisis periods. A time-varying parameter VAR (TVP-VAR) model with stochastic volatility and quarterly data from 1980Q1 to 2013Q2, structural shocks are identified by imposing sign restrictions on impulse response functions based on the theoretical model by Gerali et al. (2010). The results suggest that credit supply shocks have been an important driver of business cycle fluctuations in Euro area countries, and that their effects on the economy have generally increased since the recent crisis. Specifically, credit supply shocks contributed positively to output growth during the pre-crisis period and negatively during the downturn in economic activity in 2008-2009 in all the countries considered.

Silvestrini and Zaghini (2015) examined the impact of financial shocks on the real economy in the Euro area. A TVP-VAR model with stochastic volatility is estimated with quarterly data from 1987–Q1 to 2013Q4 to assess whether there is time variation (i.e., changing transmission) in the intensity of financial shocks. The results show that the effects of financial shocks are time-varying and contingent on the state of the economy. The impact is negligible during normal times but greatly significant in conditions of financial stress.

Kabashi and Suleva (2016) analysed the effects of loan supply in Macedonia using a Bayesian VAR model with sign restrictions and data between 1998Q1 and 2014Q4. Loan supply shocks is identified in addition to standard macroeconomic shocks, and the results indicate that loan supply shocks have no significant effect on loan volumes and lending rates, or on economic activity and prices. Meanwhile, monetary policy shocks have strong effects on inflation, while the central bank reacts strongly to adverse shocks hitting the economy. Results from historical decomposition indicate that the lending activity was supporting economic growth before and during the crisis, but its contribution became negative during the recovery and it dragged growth until the end of the period.

Houssa, Mohimont, and Orok (2015) examine the role of global and domestic shocks including productivity, credit supply and commodity price shocks in driving macroeconomic fluctuations for Ghana and South Africa. Bayesian vector autoregressive models is estimated with shocks identified using a combination of sign and recursive restrictions for the period 1980:1-2012:4. The evidence show that global shocks play a more dominant role in South Africa than in Ghana especially through the three channels of trade, credit and commodity prices. More specifically, domestic productivity and credit shocks have a muted role for Ghana.

Duchi and Elbourne (2016) investigated the macroeconomic effects of credit supply shocks in the Netherlands using a structural VAR framework with zero and sign restrictions, and quarterly date from 1998Q1 to 2014Q1. Their evidence for the Dutch economy suggests that positive credit supply shocks boosted output growth prior to 2007, while an adverse credit supply shock depressed growth between 2008 and 2012, and was insignificant to explain the sluggishness of the GDP growth since 2012. Further, credit supply shocks had considerable effect on investment than consumption implying that the former was more sensitive to credit supply shocks than the latter, and significant recovery.

Prieto, Eickmeier, and Marcellino (2016) analysed the impact and contribution of financial shocks (i.e., credit spread, house and stock price shocks) to the US economy. Based on a TVP-VAR model and quarterly data from 1958Q1 to 2012Q2, the empirical evidence show that the contribution of financial shocks to output growth fluctuate between 20 -50 percent during the Great Recession. Housing shocks were more important for the real economy since the early 2000s, with negative housing shocks being more important than positive ones. Meanwhile, an unexpected increase in credit spread led to a decline in inflation over the sample but the effect was not deflationary.

Gambetti and Musso (2017) investigate the role of loan supply shocks over the business cycle in the Euro area, the UK, and the USA. Using data over the period 1980Q1-2011Q4 and TVP-VAR model with stochastic volatility and sign restrictions. Their evidence suggests that in all three economic areas, loan supply shocks on average had a significant impact on economic activity and credit markets, and to some extent, inflation. Notable differences across the three geographic areas were observed. First, the short-term impact of loan supply shocks on loan volumes was stronger in the UK than in the Euro area or the USA. Second, the short-term impact of these shocks on real GDP and inflation increased in all three economic areas over the past few years, while the impact on loans increased mainly in the euro area and in the UK. Third, the role of loan supply shocks was more dominant during recent recessions.

Mumtaz, Pinter, and Theodoridis (2018) estimates a structural VAR model for the US economy using quarterly data from 1973 to 2013 with alternative identification schemes for recovering credit supply shocks based on sign and quantity restrictions and external instruments. The evidence show that credit supply shocks accounted for about half of the decline in real GDP growth during the most recent recession in the USA. For instance, a shock that raises the spread by 10 basis points was found to have a cumulated negative impact of about one percent on GDP growth and inflation over a year. Also, the historical decomposition suggests that the credit supply shock was responsible for a large proportion of the decline in GDP growth and inflation during the Great Recession.

Lodge and Soudan (2019) investigate the role of financial conditions in China's business cycle. Using a Bayesian VAR model with sign restrictions imposed on the impulse response functions to identify shocks to financial conditions and shocks to monetary policy, the result suggests that monetary policy, credit and financial conditions have played an important role in shaping China's business cycle. Further, conditional scenarios analysis affirmed the important role of cred following the global financial crisis in 2008. Additional evidence also shows that the financial tightening since the end of 2016 contributed to a modest slowing of credit growth and activity.

Balke, Zeng, and Zhang (2021) estimate a structural VAR model with sign restrictions identification of three credit shocks (that is, credit demand, supply of funds, and financial intermediation) for the U.S. over the period 1986Q2-2016Q4. Their results show that credit demand shocks explain significantly the variation in the long-term loan rate, supply of funds shock contributes to corporate bond yield fluctuations, and financial intermediation shock drives most of loan volume fluctuation. Moreover, financial intermediation shock had the largest impact on real economic activity especially during the 2007-2009 financial crisis. it growth in supporting activity during the past decade, particularly the surge in credit.

III. Research Design

This study will use an ex-post facto research design which relies on secondary data in examining the research objectives. Modern econometric technique is to be used to evaluate the study's research objective so as to draw statistical inference for policy recommendations. Primarily, the research analysis used variants of the Vector Auto regressive model (VAR) model framework with data covering the sample period 1986Q1 to 2022Q4, implying a total of 148 observations for each variable all retrieved from secondary data sources.

3.1 Sources of Data and Description

Table 1: Data sources and variable definitions (quarterly)

S/N	Variable	Definition/Description	Source
1	GDPG	GDP growth rate;	CBN Bulletin 2022
2	MPR	MPR (Monetary policy rate) 2006-2022; MRR (minimum rediscount rate) 1986-2005. Note: Monetary Policy Rate is called minimum discount Rate, MRR, before 2007.	CBN Bulletin 2022
3	CPI	Inflation Rate, consumer prices;	CBN Bulletin 2022
4	CPS	Credit growth is obtained based on the quarter-on-quarter percentage change in the credit to private sector by deposit money banks (DMB) in Nigeria	CBN Bulletin 2022

Source: CBN Bulletin (2022); WDI (2022).

3.2 Model specification

The VAR model in equation 11 is applied in this study to analyze the impact of shocks on monetary policy and credit supply on inflation and GDP growth

$$Z_{1t} = \beta_{10} + \sum_{i=1}^{n} \beta_{11.i} Z_{1.i,t-i} + \sum_{i=1}^{n} \beta_{12.i} Z_{2.i,t-i} + \ldots + \sum_{i=1}^{n} \beta_{1K.i} Z_{K,t-i} + \mu_{1t}$$

$$\vdots\vdots\vdots$$

$$Z_{kt} = \beta_{k0} + \sum_{i=1}^{n} \beta_{k1.i} Z_{1.i,t-i} + \sum_{i=1}^{n} \beta_{k2.i} Z_{2.i,t-i} + \cdots + \sum_{i=1}^{n} \beta_{kK.i} Z_{K,t-i} + \mu_{kt} \dots 1$$

The reduced or parsimonious form of model of Equation 11 is stated as follows;

$$Z_t = \beta_j + \sum_{i=1}^{p} \Pi_i Z_{t-i} + \varepsilon_t \dots\dots\dots\dots\dots\dots\dots\dots\dots\dots\dots\dots\dots..2$$

Where $Z_t' = (Z_{1t,}\ Z_{2t}, \dots, Z_{kt})$, $\varepsilon t = (\varepsilon_{1t}, \varepsilon_{2t}, \dots, \varepsilon_{3t})$, $\Pi_i = \begin{bmatrix} \beta_{11.i} & \beta_{12.i\cdots} & \beta_{1k.i} \\ \beta_{21.i} & \beta_{22.i\cdots} & \beta_{2k.i} \\ \vdots & \vdots & \vdots \\ \beta_{k1.i} & \beta_{k2.i} & \beta_{kk.} \end{bmatrix}$

Where equation 12 is a vector autoregressive model of order p, VAR (p), while z_t is a (4 x 1) matrix of, MPR, TBR, CPS, CPI and GDPG. whereas $\prod_i$ is a (6*6) matrix of VAR parameters to be estimated, ε_t is (4*1) vector of white noise error term also known as innovation or shocks or impulses in line with Gujarati (2012: 306), β_j is the (4*1) vector of constants, p is the total number of lags and i is the range the vector of lags covered. The VAR system can be transformed into its moving average representation in order to analyze the system's response to real oil price shock, that is:

$$Z_t = \beta_j + \mu \sum_{i=0}^{\infty} \alpha_i \varepsilon_{t-i} \dots\dots\dots\dots\dots\dots\dots\dots\dots\dots\dots\dots\dots..3$$

Where γ_0 is the identity matrix, μ is the mean of the process. The moving average representation is used to obtain the forecast error variance decomposition and impulse response functions.

IV. Data Presentation, Analysis and Discussion Of Findings

4.1 Preliminary Diagnostics

The starting point of the analysis is the presentation of some preliminary diagnostics for the variables under consideration. For ease of presentation, the variables include, Real GDP inflation (CPI) proxied by consumer price index, the Central Bank's monetary policy rate (MPR), real credit to private sector (CPS) and Gross fixed capital formation (GFCF),

To examine the stationarity properties of these variables, Table .2 presents the Phillips and Perron (1988) unit roots test at both levels and first differencing. At levels, the monetary policy rate, exchange rate and prime lending are stationary, that is, without having unit roots. This means that these variables are integrated at order zero, I(0). On the other hand, all other variables are nonstationary at levels. However, after first differencing the real GDP, consumer price level, monetary policy rate, credit to private sector, are integrated at order one, I(1). Thus, the unit roots analysis suggests that variables for the empirical analysis have mixed orders of integration. While some variables are I(0) others are I(1).

The combination of variables with different stationarity properties such as in the present case may require further exploration of possible long-run cointegration relationship among the variables. However, since the focus is on the short-run dynamics of the impact of structural shocks, differencing the variables will lead to loss of information. The common suggestion in the literature especially for structural analysis involving shocks to a system is to treat the variables in levels. For this study, all variables are treated in levels implying no first difference transformation.

Table 2.: Unit roots test (Phillips-Perron)

	Level	First Diff	Remark
RGDP	-0.3675	-2.7336*	I(1)
CPI	-2.5491	-7.3219***	I(1)
MPR	-2.6611*	-11.4141***	I(0)
GFCF	-2.8253*	-11.2253***	I(0)
CPS	-0.5312	-11.9767***	I(1)

Note: ***, **, * denotes significance at 1 percent, 5percent and 10perdect respectively.
Source: Researcher's computation.

Furthermore, for the analysis that follows, the optimal lag length selection for the VAR model. The analysis is presented in Table 3. Often, the choice is based on minimizing some statistical criteria especially the Akaike Information Criterion (AIC) and the Schwarz Information Criterion (SIC). The AIC often select models with larger lag length which results in over-parametization. The SIC on the other hand, select models with smaller lag length. For models estimated with limited data, a large model with higher lag length would reduce the degree of freedom and create parameter uncertainty. Thus, the study opts for the SIC which selects a maximum lag length of two (2) for the VAR analysis.

Table 3. Lag length selection

Lag	LogL	LR	FPE	AIC	SIC	HQ
0	-307.531	NA	2.96e-07	4.831	5.281	5.0141
1	1024.307	2467.816	1.90e-15	-14.033	-12.534	-13.424
2	1190.823	291.404	3.40e-16	-15.762	-13.213*	-14.726*
3	1267.542	126.361	2.30e-16	-16.169	-12.571	-14.707
4	1314.570	72.615	2.44e-16	-16.141	-11.493	-14.252
5	1360.902	66.773	2.67e-16	-16.1015	-10.404	-13.786
6	1467.094	142.109	1.24e-16	-16.942	-10.196	-14.201
7	1534.142	82.823*	1.06e-16*	-17.207*	-9.412	-14.040
8	1574.703	45.929	1.38e-16	-17.083	-8.238	-13.489

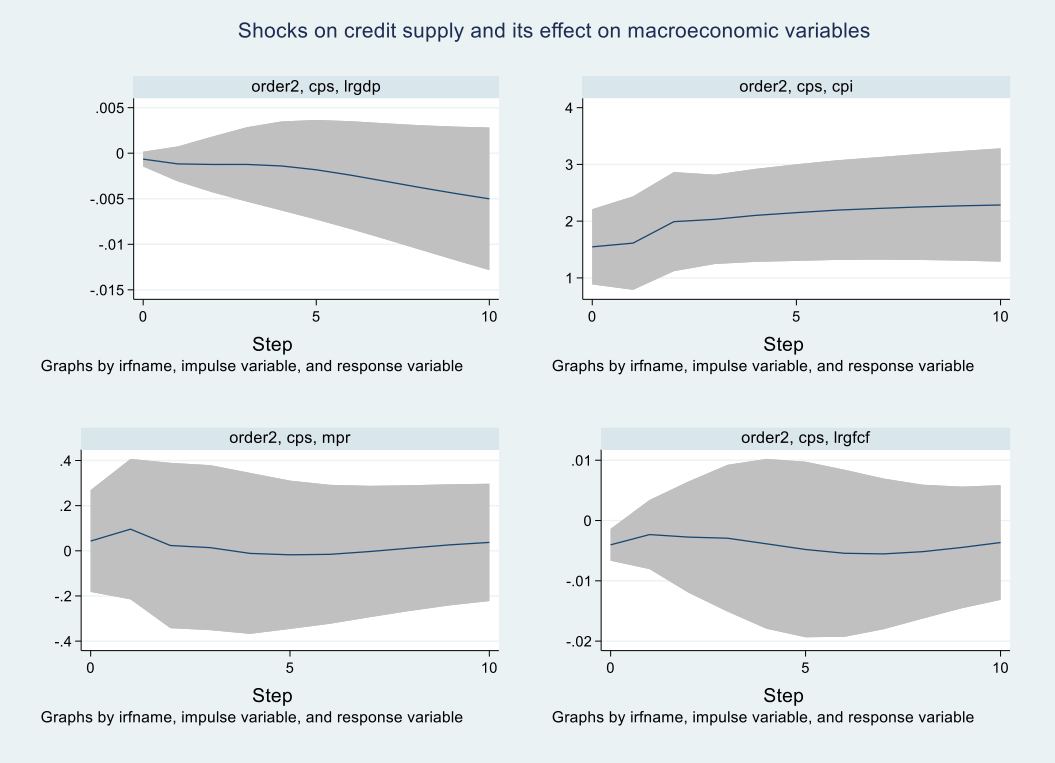
Note: * indicates lag order selected by the criterion at 5percent level. Sequential modified LR test statistics (LR), Final Prediction Error (PFE), Akaike Information Criterion (AIC), Schwarz Information Criterion (SIC), Hannan-Quinn Information Criterion (HQ)

Source: Researcher's computation

4.2VAR impulse response functions

The study seeks to establish the response of real output, monetary policy and consumer price index given a shock to credit supply. To establish this we estimated a VAR model from which we calibrated the impulse functions shown in Figure 1.

Figure 1. Response of Real GDP, MPR, CPI and RGFCF to Shocks in credit supply



Source: Authors computation.

The study estimated the response of real gross domestic production (lrgdp), monetary policy rate(mpr), consumer price index(cpi), and real gross fixed capital formation(lrgfcf) to a shock in credit supply using a VAR model. The

Evidence from the top left hand corner of fig. 1 shows real gross domestic product which is our proxy for economic growth react negatively to a shock in credit supply. The impact does not also die out even after 10 quarters. This implies that shocks to credit supply may be detrimental to output growth since it can cause a decline in real output. This finding can be interpreted to mean that credit supply alone is insufficient to stimulate output growth.

On the other hand we observe that consumer price index (cpi) reacts positively to shocks in credit supply. Consumer price index rises over the ten quarter horizon following a standard deviation shock to credit supply and the effect does not die out immediately. This could that the increases in credit supply multiplies the number of currencies chasing few goods leading to an increase in the general price level.

Also, credit supply was seen to have no significant effect on monetary policy over 10 quarters. Shocks to credit supply initially leads to an increase in the monetary policy rates, however, the effects seems to die out quickly leaving little or no effect on the monetary policy rate.

Finally, we observe that there is little or no response from gross fixed capital formation following a shock to credit supply.

V. Conclusion

The study is an attempt to investigate the response of real gross domestic product, monetary policy rate and consumer price indexto shocks in credit supply in Nigeria. Quarterly data ranging from 1984 to 2022 was employed to estimated the specified model Usingan unrestricted VAR model and calibrated the resulting impulse response function. Evidence from the impulse response indicate that shocks to credit supply negatively affects real GDP in Nigeria when observed across 10 quarters. It however, leads to positive changes in the consumer price index in the same time period.

On the other hand we observe thatcredit supply was seen to have no significant effect on monetary policy over 10 quarters. Shocks to credit supply initially leads to an increase in the monetary policy rates, however, the effects seems to die out quickly leaving little or no effect on the monetary policy rate. Also, we observe that there is little or no response from gross fixed capital formation following a shock to credit supply

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