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Monetary Policy Instruments and Performance of the Real Sectors in Nigeria

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Abstract
This paper investigates the nexus between monetary policy instruments and the real sector of the Nigerian economy. The Vector Autoregressive Distributed (VAR) lag model was employed as the methodology. Findings show that an increase in agricultural output, service output, exchange rate, and inflation rate in the previous period will lead to an increase in agricultural output in the current period. An increase in manufacturing output and interest rate in the previous period will lead to a decrease in agricultural output in the current period. An increase in agricultural output, service output, and manufacturing output in the previous period will lead to an increase in service output in the current period. An increase in agricultural output, manufacturing output, exchange rate, inflation rate, and money supply in the previous period will lead to an increase in manufacturing output in the current period. The study recommends that the monetary authority continue to revitalize the agricultural and manufacturing sectors by its policies and measures that provide credit to the sectors at a single-digit rate to boost production and job creation. The monetary authority should also target the exchange rate policy that will encourage investment in the real sector of the Nigerian economy.

Keywords: Monetary Policy Instruments, Real Sector, Nigerian Economy
JEL Codes: E52, L60, Q10, G20

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I. Introduction

Monetary policy is one of the macroeconomic management tools used to influence the aggregate demand in the real economy. The basic goals of monetary policy are promoting stable prices, sustainable output, and employment. In macroeconomic theory, monetary policy is expected to affect the real economy through movements in interest rates which would alter the cost of capital and investment in the productive sector. According to Mishkin (2007), monetary policy influences the economy through a variety of channels which include, interest rates, credit or bank lending, asset prices via exchange rates, equity, and housing prices. Investigations into the effect of monetary policy on the economy have continued to generate active research interest because the channels through which shocks are transmitted change with developments in both the global and the domestic economy.

The real sector of the economy is strategic and vital for growing the entire nation. The sector consists of agriculture, manufacturing, mining, building and construction, and services. The real sector is one of the main drivers of the economy and propels economic growth and development. It directly deals with producing goods and services using available resources, including capital and labor. It confers many benefits to the nation as it has been adjudged to have the strongest pull on a nation's economic growth and employment generation (Anyanwu, 2010). In many economies, the performance of the real sector is the gauge for assessing the effectiveness of macroeconomic policies. Government policies can only be deemed successful if they impact positively on the production and distribution of goods and services. A vibrant and productive real sector creates more linkages in the economy and promotes both internal and external balance.

The opportunity created by the real sector of the economy is to produce physical output, generate employment that yields income for investment and consumption, which reinforces the growth of aggregate demand. In recent times, monetary policy has emerged as a veritable tool for stimulating economies. Yet, the transmission process from policy pronouncements to the real sector outcomes remains a very important issue that requires continual appraisal and review. The Central Bank of Nigeria has been very active in studying the transmission mechanism of monetary policy in Nigeria. The outcomes of these studies have helped in sharpening the instruments of policy and modeling the operating frameworks. These studies have also been invaluable in designing special intervention schemes where open market credit pricing has not provided enough stimuli for priority sectors (Central Bank of Nigeria, 2014).

Understanding the responses of the disaggregated components specifically the Agriculture, Manufacturing, and Services sub-sectors of the real economy is important. A disaggregation is imperative given that different sectors have different capital intensities that generate different responses in sectoral output from monetary policy. These differences in responses are largely disguised at an aggregate level – thus making the disaggregated approach more informative than the aggregate method to analyze the transmission mechanism of monetary policy (Dedola & Lippi, 2005). Apere and Karimo (2015) argued that monetary policy efforts to revitalize the agricultural sector should focus more on the use of differential interest rates amongst other policy tools.

Furthermore, knowledge of the size, timing, and persistence of monetary policy shocks on economic activities provides the monetary authority with vital information required to fine-tune policy initiatives towards stabilizing the macroeconomy, and the real sector, in particular. Osakwe, Ibenta, and Ezeabasili (2019) opined that money supply and treasury bills be used in the short- run as policy instruments to maintain macroeconomic stability in Nigeria concerning the manufacturing sector. This study is yet another step in unraveling the functional connection between monetary policy and the real sector of the Nigerian economy. It explicitly assesses the impact of monetary policy on the real economy.

II. Empirical Review

Studied the effect of monetary policy on industrial growth in Nigeria, Uju and Ugochukwu (2021) employed the Ordinary Least Square regression technique with time-series data from 1986 to 2019. The results showed that open market operation measured by treasury bill rate had a positive and significant effect on the Nigerian manufacturing domestic sector gross product; cash reserve ratio has a positive and significant effect on the Nigerian manufacturing sector gross domestic product, and monetary policy rate has a negative and significant effect on the Nigerian manufacturing sector gross domestic product. The study concludes that monetary policy is a veritable tool for enhancing industrial sector growth in Nigeria.

Osakwe et al. (2019) examined the effect of monetary policy on the performance of the manufacturing sector in Nigeria. The explanatory variables are monetary policy rate, Treasury bills rate, Cash reserve requirement, and money supply; while the dependent variable is the Manufacturing sector output. The Autoregressive Distributive Lag (ARDL) was used for the model estimation. The results indicate that: monetary policy tools have a significant effect on the manufacturing sector output in Nigeria in the short-run only. The study concluded that monetary policy tools may not be a long-run policy instrument for the growth of the manufacturing sector output in Nigeria but rather short-run instruments.

Ezeaku et al (2018) examined the monetary policy transmission channels on industry performance in Nigeria within the period 1981 to 2014. Using the Error Correction Model and Johansen cointegration technique, three channels of monetary policy transmission being bank channel (private sector credit), interest rate channel (real lending rate) and exchange rate channel was regressed on real output measured as the contribution of the industrial sector to GDP. The study found a long-run relationship between monetary policy and industrial output with about 72% annual speed of adjustment. However, all the channels of monetary policy transmission had an insignificant negative effect on industry performance with about 61% significant explanatory power.

Eko, Ogbeba, and Okoi (2017) employed the Vector Error Correction Model and Granger causality test to investigate the impact of monetary policy shocks on industrial output in Nigeria between 1970 and 2015. The data on the contribution of the manufacturing and solid minerals subsectors to GDP was employed as the dependent variable while explanatory variables included monetary policy rate, exchange rate, and bank credit to the industrial sector. Findings revealed that the manufacturing sub-sector had a positive influence on the monetary policy rate, commercial bank credit to the industrial sector, and exchange rates, while the contribution of solid minerals sub-sector to GDP responded positively to shocks in commercial bank credit to the industrial sector and exchange rate after the first year. The causality test indicated a unidirectional relationship running from monetary policy rate and exchange rate to the contribution of the manufacturing sector to GDP on the one hand, and commercial bank credit to the industrial sector and exchange rate to the contribution of solid mineral sector to GDP.

Onakoya, Ogundajo, and Babatunde (2017) investigated the extent to which sustainability of the manufacturing sector can be maintained using the monetary policy stance. The study, using time series data covering 1981 to 2015, employed the Johansen co-integration and Vector Error Correction model for data analyses. The results confirmed the existence of a long-run relationship among the variables. A positive relationship between monetary policy and manufacturing sector performance in Nigeria was observed at the 5% level of statistical significance. No short-run association between the external reserves and inflation rates was recorded. The study concludes that monetary policy has a significant effect on manufacturing output in Nigeria.

Igbinedion and Ogbeide (2016) employed the error-correction approach to examine the relationship between monetary policy and manufacturing capacity utilization in Nigeria within a period covering 1980 and 2014. The results revealed that monetary policy variables significantly explained about 81% of variables in manufacturing sector performance. Bank credit, money supply, and exchange rate were found to have a positive effect on manufacturing sector performance at levels while interest rate was found to hurt manufacturing sector performance at one year lag. General results from error term, variance decomposition, and impulse response showed that monetary policies explain relatively significant variations in manufacturing performance in Nigeria.

Apere and Karimo (2015) investigated the transmission channel of monetary policy shocks to agricultural output growth over the period 1970 – 2012. The study estimated a VAR model and showed that producers can effectively transfer increases in the cost of production to the final consumer through increased prices; and that though monetary policy shocks, interest rate and consumer prices have dominant impacts on agricultural output growth in Nigeria, but that monetary policy shocks transmitted through the interest rate channel are more effective.

Using a time series covering 1970 to 2010, Owolabi and Adegbite (2014) investigated the effect of monetary policy on the growth of the Nigerian industry. The multiple regression techniques were adopted to regress monetary policy tools including Treasury Bills, Deposit & leading, and Rediscount Rate on manufacturing output. It was found that monetary policy tools had 81.56% significant explanatory powers in determining industrial growth in Nigeria. Further findings revealed that rediscount rate and deposit rate have a significant positive effect on industrial output while Treasury Bills hurt industrial output.

Charles-Anyaogu (2012) examined the performance of monetary policy on the manufacturing index performance in Nigeria between 1980 and 2009. The study employed granger causality to test for impact, while VEC and OLS were used to examine the significance, magnitude, direction, and relationship of some macroeconomic variables (lending rate, income tax rate, money supply, Inflation rate, and Exchange rate) on the Manufacturing index in Nigeria. The results showed that Money Supply positively affect the manufacturing sector performance by 0.5% while others played a negative impact on the performance of the manufacturing sector over the years.

III. Theoretical Framework and Methodology

3.1 Theoretical Framework

There are different transmission channels through which monetary policy affects economic activities. These channels have been broadly examined under the monetarist and Keynesian schools of thought. The monetarist postulates that change in the money supply leads directly to a change in the real magnitude of money. Friedman and Schwartz (1963) contended that expansive open market operations by the Central Bank increase the stock of money, which also leads to an increase in commercial banks reserves and ability to create credit and hence increase the money supply through the multiplier effect. To reduce the quantity of money in their portfolios, the bank and non-bank organizations purchase securities with characteristics of the type sold by the Central Bank, thus stimulating activities in the real sector. This view is supported by Tobin (1978) who focused on assets portfolio choice and revealed that monetary policy triggers asset switching between equity, bonds, commercial paper, and bank deposits. According to Tobin, tight monetary policy affects the liquidity and banks' ability to lend thus restricting loans to prime borrowers and business firms to the exclusion of mortgages and consumption spending thereby contracting effective demand and investment.

The Keynesians on the other hand posit that change in money stock facilitates activities in the financial market affecting interest rate, investment, output, and employment. Modigliani (1963) supports this view but introduced the concept of capital rationing and said the willingness of banks to lend affects monetary policy transmission. In their analysis of the use of bank and non-bank funds in response to tight monetary policy Oliner and Rudebush (1995) observe that there is no significant change in the use of either but rather larger firms crowd out small firms in such times and in like manner Gertler and Gilchrist (1991) supports the view that small businesses experience a decline in loan facilities during tight monetary policy and they are affected more adversely by changes in bank-related aggregates like broad money supply. Further investigation by (Borio, 1995) who investigated the structure of credit to non-government borrowers in fourteen industrialized countries observe that it has been influenced by factors such as interest rates, collateral requirement, and willingness to lend. The theoretical framework of this study is therefore based on monetarist theory.

3.2 Model Specification

Following the link between monetary policy transmission mechanism and economic growth, this study used macroeconomic models that permit the simulation of the influence of monetary policy instruments on the real sector of the Nigerian economy. The models consist of three behavioral equations and five explanatory variables. The methodology to be employed is the Vector Autoregressive Distributed lag model (VAR) for estimation of the time series data. The study used VAR to enable us to examine the impact of monetary policy on the real sector of the Nigerian economy. This study adapted the work of Owolabi and Adegbite (2014) and Apere and Karimo (2015), using agricultural, manufacturing, and service sector output as dependent variables, with the functional relationship specified as follows:

AGR = f(INT, EXR, MS, INF) 1

MAN = f(INT, EXR, MS, INF) 2

SER = f(INT, EXR, MS, INF) 3

Thus, the VAR models can be express as follows:

$$AGR_t = \propto_0 + \sum_{j-i}^{m} \propto_{1j} AGR_{t-i} + \sum_{j-i}^{m} \propto_{2j} INT_{t-j} + \sum_{j-i}^{m} \propto_{3j} EXR_{t-j} + \sum_{j-i}^{m} \propto_{4j} MS_{t-j} + U_{1t} \quad 4$$

$$MAN_t = \beta_0 + \sum_{j-i}^{m} \beta_{1j} MAN_{t-i} + \sum_{j-i}^{m} \beta_{2j} INT_{t-j} + \sum_{j-i}^{m} \beta_{3j} EXR_{t-j} + \sum_{j-i}^{m} \beta_{4j} MS_{t-j} + U_{2t} \quad 5$$

$$SER_t = \lambda_0 + \sum_{j-i}^{m} \lambda_{1j} SER_{t-i} + \sum_{j-i}^{m} \lambda_{2j} INT_{t-j} + \sum_{j-i}^{m} \lambda_{3j} EXR_{t-j} + \sum_{j-i}^{m} \lambda_{4j} MS_{t-j} + U_{3t} \quad 6$$

Where:

ARG = Agricultural Output

MAN = Manufacturing Output

SER = Service Output

INT = Interest Rate

EXR = Exchange Rate

MS = Money Supply

INF = Inflation Rate

α_0, β_0 and λ_0 are intercepts while $\alpha_1 - \alpha_4$, $\beta_1 - \beta_4$ and $\lambda_1 - \lambda_4$ are all slopes of the regressions and U = Error term

Apriori expectation determined by the principle of economic theory guiding the economic relationship among variables under study, is that α_1, β_1 and $\lambda_1 < 0$; α_2, β_2 and $\lambda_2 < 0$; α_3, β_3, and $\lambda_3 < 0$ while α_4, β_4, and $\lambda_4 > 0$.

IV. Results and Discussion

4.1 Unit Root Test

Table 1: Unit Root Test Result

Variable	ADF Statistics	Critical Value	Stationary Status
AGR	-7.460302	-4.26274(1%) -3.55297(5%) -3.20964(10%)	I(1)
MS	-8.382534	-4.26274(1%) -3.55297 (5%) -3.20964(10%)	I(0)
SER	-6.009893	-4.26274(1%) -3.55297 (5%) -3.20964(10%)	I(1)
MAN	-5.860210	-4.5743 (1%) -3.6920 (5%) -3.2856 (10%)	I(0)
INT	-3.860210	-3.5743 (1%) -2.6920 (5%) -1.2856 (10%)	I(1)
INF	-8.382534	-4.26274(1%) -3.55297 (5%) -3.20964(10%)	I(1)
EXR	-6.009893	-4.26274(1%) -3.55297 (5%) -3.20964(10%)	I(1)
The critical values for rejection of the hypothesis of unit root were from MacKinnon (1991) as reported in e-views 9.0.			

Source: Author's Computation, 2021

The seven variables (AGR, MAN, SER, MS, INT, INF, and EXR) underwent a unit root test using the Augmented Dickey-Fuller (ADF) test. the result showed that all the variables were found to be non-stationary at levels but only MS and MAN were stationary at levels while five variables (AGR, SER, INT, INF, and EXR) were found to be stationary after the first difference.

4.2 Co-Integration Test

The study proceeds with Johansen co-integration test having established that all series are not stationary in the same order. The co-integration test allows for the testing of the long-run equilibrium relationships among the series. The result obtained from Johansen and Juselius (1990) is presented in table 2. The result is based on the eigenvalue test and trace test to determine the number of co-integration vectors.

Table 2: Johansen Co-integration Test

Series: AGR EXR INF INT MAN MS SER

Lags interval (in first differences): 1 to 2

Unrestricted Cointegration Rank Test (Trace)				
Hypothesized		Trace	0.05	
No. of CE(s)	Eigenvalue	Statistic	Critical Value	Prob.**
None *	0.990905	457.7276	139.2753	0.0000
At most 1 *	0.980929	293.2249	107.3466	0.0000
At most 2 *	0.785590	154.6399	79.34145	0.0000
At most 3 *	0.777376	100.7446	55.24578	0.0000
At most 4 *	0.604139	48.16513	35.01090	0.0012
At most 5	0.357568	15.73094	18.39771	0.1136
At most 6	0.006937	0.243639	3.841466	0.6216
Trace test indicates 5 cointegrating eqn(s) at the 0.05 level				
* denotes rejection of the hypothesis at the 0.05 level				
**MacKinnon-Haug-Michelis (1999) p-values				

Source: Author's Computation, 2021

The table shows the long-run relationship existing among the variables of the study. The table shows the variables that converge in the long run thereby depicting the existence of long-run relationships among them. The long-run relationship exists at 5% level of significance according to the Trace test statistics and the Eigenvalue. This implies there exists four (4) co-integrating relationships among the variables. Therefore there is a long-run relationship among the variables.

4.3 VAR Lag Order Selection Criteria

Table 3: VAR lag Selection

Lag	LogL	LR	FPE	AIC	SC	HQ
1	-1268.173	NA	9.16e+19*	60.14759*	61.17154*	60.52519*
2	-1247.165	32.24495	1.15e+20	60.33326	62.38117	61.08846
3	-1233.490	17.80920	2.16e+20	60.86001	63.93187	61.99281
4	-1206.189	29.20563	2.46e+20	60.75299	64.84880	62.26340
* indicates lag order selected by the criterion						
LR: sequential modified LR test statistic (each test at 5% level)						
FPE: Final prediction error						
AIC: Akaike information criterion						
SC: Schwarz information criterion						

Source: Author's Computation, 2021

To estimate the VAR model, it is necessary to get the optimal lag length using Lag length selection criteria. Lag length selection criteria of VAR start with the specification of a maximum lag of 4. An asterisk (*) indicates the selected lag from each column of the criterion statistic. From the result in table 3, we considered the first (1) lag length as the optimal lag length for each endogenous variable based on the Schwarz information criterion (SIC). Schwarz information criterion is chosen because it has shown to have a higher degree of precision when compared to other criterions such as the Akaike information criterion (AIC).

4.4 Estimated Vector Autoregressive (VAR) Model

Table 4: VAR Estimated Result Based on SIC

	AGR	SER	MAN
AGR(-1)	0.913239	0.758124	0.101819
	(0.08036)	(0.08961)	(0.06123)
	[11.3644]	[8.46021]	[1.66289]
SER(-1)	0.104413	0.526521	-0.216417
	(0.11310)	(0.12612)	(0.08618)
	[0.92315]	[4.17460]	[-2.51122]
MAN(-1)	-0.202621	1.006126	1.054388
	(0.24144)	(0.26923)	(0.18397)
	[-0.83922]	[3.73698]	[5.73141]
EXR(-1)	10126.00	-9376.421	1972.084
	(2341.98)	(2611.58)	(1784.48)
	[4.32369]	[-3.59032]	[1.10513]
INF(-1)	3295.009	-80.55620	1647.915
	(4221.62)	(4707.60)	(3216.67)
	[0.78051]	[-0.01711]	[0.51230]
INT(-1)	-10212.43	-7829.532	-5735.854
	(16217.1)	(18084.0)	(12356.7)
	[-0.62973]	[-0.43295]	[-0.46419]
MS(-1)	-0.018134	-0.039458	0.259030
	(0.09186)	(0.10244)	(0.07000)
	[-0.19740]	[-0.38518]	[3.70062]
C	41440.97	88337.74	3614.857
	(228720.)	(255049.)	(174273.)
	[0.18119]	[0.34636]	[0.02074]
R-squared	0.998106	0.999265	0.993869
Adj. R-squared	0.997649	0.999088	0.992390
Sum sq. resids	4.43E+12	5.50E+12	2.57E+12
S.E. equation	390659.7	435630.9	297663.9
F-statistic	2183.679	5633.399	671.6321
Log likelihood	-524.3906	-528.4221	-514.3314
Akaike AIC	28.77787	28.99579	28.23413
Schwarz SC	29.12618	29.34410	28.58243
Mean dependent	6451173.	10210546	2486155.
S.D. dependent	8057538.	14423189	3412125.
Determinant resid covariance (dof adj.)		4.17E+50	
Determinant resid covariance		7.58E+49	
Log-likelihood		-2492.281	
Akaike information criterion		137.7449	
Schwarz criterion		140.1831	

Source: Author's Computation, 2021

The VAR equations for the agricultural output model showed that a unit increase in AGR, SER, EXR, and INF in the previous period will lead to 0.913239, 0.104413, 10126, and 3295.009 increases in AGR at the current period. A unit increase in MAN and INT in the previous period will lead to a 0.202621 and 10212.43 decrease in AGR at the current period. From the services output model, a unit increase in AGR, SER, and MAN in the previous period will lead to 0,758124, 0.526521, and 1.006126 increases in SER at the current period. A unit increase in EXR, INF, INT, and MS in the previous period will lead to 1972.084, 80.55620, 7829.535, and 0.039458 decreases in SER at the current period. Also, From the manufacturing output model, a unit increase in AGR, MAN, EXR, INF, and MS in the previous period will lead to 0.101819, 1.054388, 1972.084, 1647.915, and 0.259030 increases in MAN at the current period. A unit increase in SER and INT in the previous period will lead to a 0.216417, 5735.854 decrease in MAN at the current period

4.5 VAR Forecast Error Variance Decomposition

Table 5: Variance Decomposition

Variance Decomposition of AGR:								
Period	S.E.	AGR	MAN	SER	EXR	INF	INT	MS
1	161318.3	100.0000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000
2	220407.2	67.71943	2.319975	5.460234	4.383264	7.877942	0.082167	12.15699
3	372310.8	31.66132	11.97146	21.85931	8.860697	6.754700	2.018303	16.87421
4	506568.5	19.89574	15.08285	21.98216	27.09120	3.997126	1.092236	10.85869
5	753438.5	47.64918	8.085280	10.11966	18.72410	1.951701	4.575015	8.895066
6	863669.4	49.02041	6.833563	7.728336	21.78590	2.070620	5.492518	7.068647
7	1129938.	50.58569	4.091216	6.041149	28.86278	2.422568	3.866859	4.129737

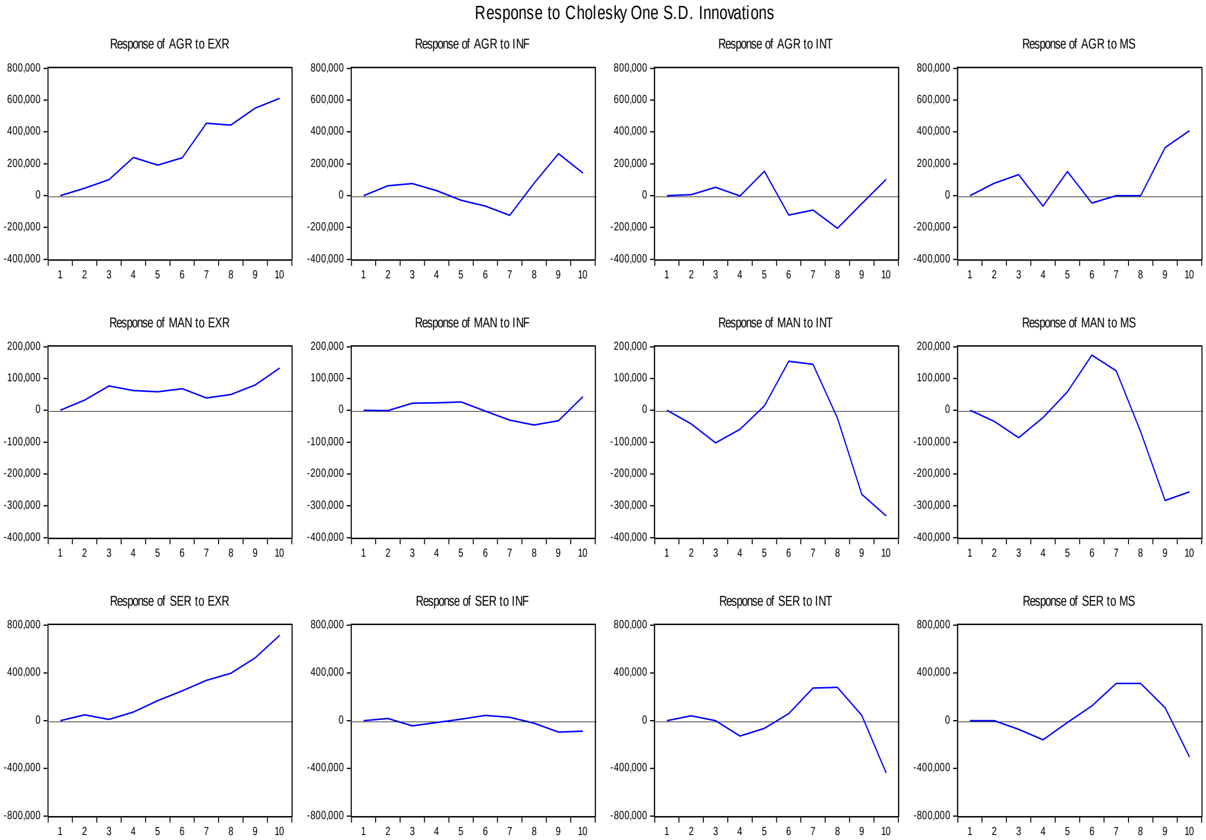
8	1305948.	44.52120	3.963522	7.799934	33.07682	2.164251	5.382690	3.091577
9	1602691.	43.57432	2.769803	6.537530	33.72736	4.123428	3.674830	5.592723
10	1927364.	44.60838	1.964296	5.528446	33.35760	3.381070	2.824606	8.335602
Variance Decomposition of MAN:								
Period	S.E.	AGR	MAN	SER	EXR	INF	INT	MS
1	82709.52	60.61033	39.38967	0.000000	0.000000	0.000000	0.000000	0.000000
2	166523.1	67.91000	10.30924	7.074936	3.790236	0.005548	6.626298	4.283739
3	244844.8	41.13170	6.376897	5.455129	11.43622	0.820335	20.50330	14.27642
4	272588.1	34.19611	5.517799	10.81719	14.46859	1.400221	21.39136	12.20873
5	293749.7	29.81553	6.731587	11.84619	16.43161	2.033477	18.64465	14.49696
6	392358.0	21.85422	3.796788	7.528544	12.22096	1.143408	25.78678	27.66929
7	486011.4	26.08861	3.262725	10.67670	8.619477	1.152113	25.67993	24.52044
8	575076.6	39.19371	2.690841	12.32802	6.890087	1.476212	18.50967	18.91146
9	724374.9	31.32104	2.058921	7.772827	5.555525	1.129816	24.91554	27.24633
10	871081.6	21.77325	3.625751	8.177514	6.158425	1.017876	31.72275	27.52444
Variance Decomposition of SER:								
Period	S.E.	AGR	MAN	SER	EXR	INF	INT	MS
1	210365.7	0.281416	31.37355	68.34503	0.000000	0.000000	0.000000	0.000000
2	278908.8	7.442961	26.55396	60.82135	2.837685	0.383679	1.954126	0.006240
3	324831.7	19.60967	19.77515	49.56935	2.151193	2.320479	1.441368	5.132792
4	429471.0	19.72490	18.96542	28.92401	3.983283	1.464128	10.01748	16.92078
5	521281.8	19.77781	25.70680	20.57942	12.94382	1.036202	8.382029	11.57392
6	638746.5	13.74302	29.68520	13.97466	23.69119	1.152095	6.387573	11.36627
7	906484.6	20.25682	16.94746	6.943486	25.62815	0.667204	12.17541	17.38146
8	1266272.	36.96949	8.878971	4.889098	22.91303	0.369276	11.05701	14.92312
9	1704292.	53.54763	4.917514	4.097441	22.11988	0.527378	6.163735	8.626420
10	2172463.	53.70754	3.479436	2.719181	24.37497	0.493389	7.918396	7.307095
Cholesky Ordering: AGR MAN SER EXR INF INT MS								

Source: Author's Computation, 2021

Variance decomposition indicates the amount of information each variable contributes to the other variables in the autoregressive. It determines how much of the forecast error variance of each of the variables can be explained by exogenous shocks to the other variables. It is generated from the estimated VAR. Table 5 considering 10 periods. The shocks are Money Supply (MS), Exchange Rate (EXR), Inflation Rate (INF), and Interest Rate (INT) while the responses are MAN, SER, and AGR. From the variance decomposition for AGR, AGR account for most of the variations and changes in itself, the next is the exchange rate (EXR), then Money supply (MS) while MAN account for the least variations in AGR. From the variance decomposition for MAN, AGR account for most of the variations and changes in MAN, the next is Interest Rate (INT), then Money supply (MS) while INF account for the least variations in MAN. From the variance decomposition for SER, AGR account for most of the variations and changes SER, the next is Exchange Rate (EXR), then Interest Rate (INT) while INF account for the least variations in MAN.

4.6 Impulse Response Function

Impulse is an unexpected shock on an economic variable, the reaction of another economic variable to the impulse is referred to as response. It is derived from the estimated SVAR. Just like the Variance Decomposition, shock3 represents Money Supply (MS) shock4 Represent Monetary Policy Rate (MPR) and Shock5 represent Interest Rate (INT). Impulse Response Function (IRF) graphical representation for five periods is given as:



Source: Author's Computation, 2021
Figure 1: Impulse Response Function

The impulse response indicated that AGR respond positively to changes in EXR in periods 1 to 10. AGR responds positively to changes in INF in periods 1 to 5 negatively in periods 6 and 7 and positively in periods 8 to10. AGR responds to changes in INT and MS fluctuate from positive to negative. MAN responds positively to changes in EXR in periods 1 to 10. MAN responds positively to changes in INF in periods 1 to 5 negatively in periods 6 and 7 and positively in periods 8 to 10. MAN responds to changes in INT and MS fluctuate from positive to negative. SER respond positively to changes in EXR in period 1 to 10. SER respond positively to changes in INF in period 1 to 5 negatively in periods 6 and 7 and positively in periods 8 to10. SER responds to changes in INT and MS fluctuate from positive to negative.

4.7 Post Estimation

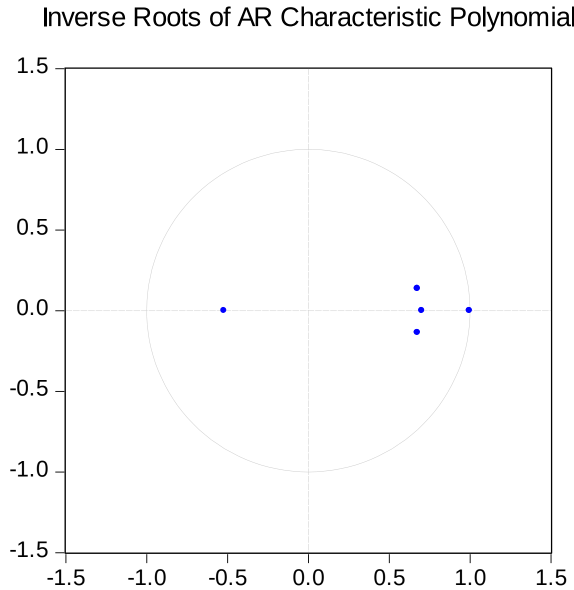
It is a necessity to test the VAR model for stability to validate the Impulse response function and variance decomposition results. This can be done using the AR Root method. The conditions to declare a model stable using AR roots are: all roots must lie within the polynomial bound and the roots must be less than one. Below is the tabular and graphical representation of the AR Roots test.

Table 6: Roots of Characteristic Polynomial

Endogenous variables: AGR MAN SER INT INF EXR MS	
Root	Modulus
0.996938	0.996938
0.702172	0.702172
0.673998 - 0.137061i	0.687793
0.673998 + 0.137061i	0.687793
-0.521727	0.521727
No root lies outside the unit circle.	
VAR satisfies the stability condition.	

Source: Author's Computation, 2021

This shows that the values of the roots are less than unity. Also, the modulus values are less than unity and the inverse roots of the AR characteristic polynomials lie within the unit circle. Based on these observations we conclude that the estimated SVAR model is stable.



Source: Author's Computation, 2021
Figure 2: AR Stability Test

The laying of all the roots within the polynomial is an indication that the model is good and stable and can be used for forecasting and policy decisions.

4.8 Implication of Findings

The study reveals that there is a long-run relationship between the key variables of the study which include agricultural output, manufacturing output, interest rate, exchange rate, and inflation rate. Due to the long-run relationship between the variables, Vector Autoregressive (VAR) model was used to estimate the time-series data. An increase in agricultural output, service output, exchange rate, and inflation rate in the previous period will lead to an increase in agricultural output in the current period. An increase in manufacturing output and interest rate in the previous period will lead to a decrease in agricultural output in the current period. An increase in agricultural output, service output, and manufacturing output in the previous period will lead to increases in service output in the current period. An increase in the exchange rate, inflation rate, interest rate, and money supply in the previous period will lead to decreases in service output at the current period. An increase in agricultural output, manufacturing output, exchange rate, inflation rate, and money supply in the previous period will lead to increases in manufacturing output in the current period. A unit increase in service output and interest rate in the previous period will lead to a decrease in manufacturing output at the current period.

Variance decomposition indicates the amount of information each variable contributes to the other variables in the autoregressive. From the variance decomposition for agricultural output, agricultural output accounts for most of the variations and changes in itself, the next is the exchange rate, then money supply while manufacturing output account for the least variations in agricultural output. From the variance decomposition for manufacturing output, agricultural output accounts for most of the variations and changes in manufacturing output, the next is the interest rate, then money supply while inflation rate account for the least variations in manufacturing output. From the variance decomposition for service output, agricultural output account for most of the variations and changes in service output, the next is the exchange rate, then the interest rate while the inflation rate account for the least variations in manufacturing output.

To achieve an increase in economic growth in the real sector of the Nigerian economy which includes, agricultural, manufacturing, and service sectors, the government should reduce interest rates which will encourage borrowing for expansion of investment in the agricultural sector, manufacturing sector, and service sector. This will increase agricultural outputs in the economy and will improve the non-oil export share of the gross domestic product (GDP). The increase in investment in the real sector will increase employment generation and improve the standard of living of the citizens. Also, an increase in the export of agricultural output will bring in foreign exchange making funds available to manufacturers that import equipment and raw materials for their product, among others. This will further boost the non-oil exports receipts of foreign currency complementing the oil exports receipts, which are vulnerable to external shocks. Pressure on the local currency to purchase foreign currency will be reduced bringing about stability in the foreign exchange market. Since money supply increases the output in the agricultural sector, the federal government through its different agencies like the Central Bank of Nigeria, Bank of Industry, Bank of Agriculture, and Federal Ministry of Finance, among others should continue to provide finance for interventions in the agricultural sector, manufacturing sector and service sector of the Nigerian economy. These will in turn improve the real sector of the economy.

V. Conclusion and Recommendations

Monetary policy plays a significant role in the operation of economies. Differences in transmission mechanisms can generate asymmetric behavior between monetary policy and the real sector. The size, timing, and persistence of contractions in sectoral output confirmed the sensitivity of some sectors to monetary policy shocks. The most sensitive sector to unanticipated shock in monetary policy is the agricultural and manufacturing sectors. This was followed by services sectors. The agriculture sector showed a positive response to this characterization. The size and timing of the maximum impacts of agricultural and manufacturing sectors have important implications as they constitute significant drivers of induced impact on the service sector that showed initial lagged responses.

Besides, the sectors that showed a more persistent decline in output are agriculture and manufacturing which demonstrate that restrictive monetary policy has longer lasting effects on these sectors as compared to the services sector where monetary effects are relatively short-lived. The results of the contemporaneous structural coefficients show that the interbank interest rate has a negative and statistically significant impact on disaggregated output in all the sectors, while money supply, in general, exhibits a statistically significant positive effect on the sectoral output components. The variance decomposition corroborates the above findings as to the most important monetary policy variables that explain the variation in sectoral output are interbank call rate and money supply. Innovations from the monetary policy rate and exchange rate do not significantly explain the variations in output.

The recommendations of the study based on the findings include The revitalization of agricultural and manufacturing sectors by the monetary authority providing credit to the sectors an interest rate that will attract investors into the sectors. Funds allocated for agricultural and manufacturing sectors to increase the output of these sectors should be monitored thoroughly to ensure that they are not diverted to other uses. Since money supply was seen to have positive effects on the real sector's output, the monetary authority should employ an expansionary monetary policy that can increase the money supply to the real sectors and boost output performance in the Nigerian economy. The monetary authority should target the exchange rate policy that will encourage investment in the real sector of the Nigerian economy and ensure the stability of the foreign exchange market.

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