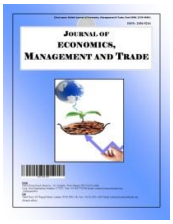

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Monetary Policy and the Real Economy: A Study of the Manufacturing and Services Sectors in Nigeria

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Author's contribution

The sole author designed, analysed, interpreted and prepared the manuscript.

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ABSTRACT

This study examined the effect of monetary policy on the real sector of the Nigerian economy. A model was specified for each of the manufacturing and services sectors to interrogate the effect of monetary policy on the real sector. Annual data were sourced from the World Development Indicators for 1981 to 2017. Preliminary tests of the time series properties suggested the autoregressive distributed lag (ARDL) regression as the most appropriate framework for the achievement of our objectives. Diagnostic tests of the distribution of regression errors confirmed the satisfaction of all necessary regression assumptions. The models were also found stable over the study period. Thus, the models adequately represented the problems formulated for investigation and good for valid inference. While all the four channels of monetary transmission considered were found significant for value-added expansion in manufacturing, the exchange rate channel was not a significant factor in value-added change in the services sector. Our findings suggested that domestic credit is the dominant channel for the transmission of monetary impulses to the real sector. The study concluded that monetary policy will benefit the real economy more with export expansion in both the manufacturing and services sectors.

Keywords: ARDL; monetary policy; manufacturing; services; diagnostics; Nigeria.

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1. INTRODUCTION

Central banks in achieving their core mandates initiate policy-induced changes in the nominal money stock or the short term nominal interest rate to affect the behavior of individuals and firms culminating in changes in real aggregates such as output and employment. The 1958 Act of Parliament as amended in 1991, 1993, 1997, 1998, 1999 and 2007 charged the Central Bank of Nigeria (CBN), among other core mandates, to ensure monetary and price stability and maintain an appropriate level of external reserves necessary to safeguard the international value of the national currency. In addition to its core mandates, the CBN also performs targeted developmental functions focused on all key sectors of the economy. The CBN monetary policy actions are geared to achieving set targets such as promoting employment, control of inflation, and to spur economic growth by manipulating monetary aggregates such as interest rates, money supply, bank credit, and the exchange rate. In this regard, therefore, monetary policy plays an important role in achieving the ultimate economic objectives of sustainable growth, full employment, price stability and a healthy balance of payments. Thus, the monetary policy conducted by the CBN is a meaningful policy tool for structural transformation. For instance, The Economic Recovery and Growth Plan 2017-2020 [1] requires the CBN to strengthen intervention in critical sectors of the economy capable of promoting economic growth and reducing unemployment. In response, the CBN is currently supporting growth in the economy through its dedicated support to medium, small and micro enterprises (MSMEs) and the agricultural sector through initiatives such as the Anchor Borrowers Programme which allowed participants in the agricultural value chain to access credit at single-digit rates of interest. Past studies on the effects of monetary policy on the real economy in Nigeria have largely dealt with the aggregate economic performance measured by the GDP, However, from the standpoint of the evolution of the structure of the Nigerian economy in the recent times which witnessed the ascendancy of the services sector as the largest contributor to the gross domestic product (GDP) and the resurgence of the manufacturing sector, this study will specifically interrogate the impact of monetary policy on two specific sectors of the real economy. We seek to ascertain if monetary policy has differential effects on the manufacturing and services sectors. If the two sectors are influenced in the same way, in which of the sectors is monetary policy more effective?

The goal of central banking in most countries is the management of the balance between price and output stability. Thus, monetary policy essentially entails the adjustment of the money supply to achieve a combination of price and output stabilization [2]. Following Poole's analysis [3] which shows that monetary policy insulates output and prices from the effects of large and unpredictable disturbances to the money demand relationship by setting a target for nominal interest rate rather than money supply, most central banks today choose to conduct monetary policy via a target for the short-term nominal interest rate as opposed to nominal money stock adjustment. Thus, in practice, monetary policy actions are almost always described in terms of their impact on short-term nominal interest rate [4]. Monetary policy plays a stabilizing role in influencing economic growth through the maintenance of price stability. Evidence from theory and empirical studies suggest that sustainable long-term growth is associated with lower price levels, and that high inflation is damaging to long-run economic performance and welfare. As a tool of managing aggregate demand in the economy, monetary policy holds several advantages over fiscal policy. Monetary policy can be adjusted quickly in response to macroeconomic imperatives and as a result provides much flexibility for achieving medium-term stabilization objectives [5]. Fiscal policy, on the other hand, takes time to process changes in tax and government spending through the legislature, and once such changes have become law they are often politically difficult to reverse. Besides, consumers may not respond in the intended way to fiscal stimulus if they chose to save rather than spend a tax cut [2]. Therefore, monetary policy is generally seen as the government's first line of defense in stabilizing the economy during a recession.

Monetary policy actions influence real output and employment through several channels called the transmission mechanism. To the Keynesians, an expansionary change in money supply permanently changes real output by lowering the rate of interest and through the marginal efficiency of capital stimulate investment and output growth [6,7]. However, the traditional Keynesian interest rate channel posits that a

policy-induced increase in the short-term nominal interest rate leads in the first instance to an increase in longer-term nominal interest rates. The arbitrage activities of investors coupled with slow adjustment of nominal prices ultimately translate into movements in real interest rates as well. Firms, now faced with increased real cost of borrowing cut back on their investment expenditures. Similarly, households facing higher real borrowing costs scale down on their purchases of durable goods, and aggregate output and employment falls [8]. This interest rate channel lies at the heart of the new Keynesian perspective [9], according to which the dynamic effect of monetary policy, in terms of temporary output effects and permanent price effects, results from optimizing dynamic behavior, rational expectation, and price rigidities. The financial deepening hypothesis on the interest rate channel contrariwise argued that a market-force induced higher interest rate would enhance more investment by routing saving to productive investment and stimulate real output growth [10,11]. For this reason, proponents of the financial liberalization hypothesis are confident of a positive association between real interest rates and economic growth. But according to Barro and Becker [12] incorporating discounting factor into their model argued that real interest rates and economic growth are negatively associated.

In open economies, monetary actions also have real effects through the exchange rate channel. Loayza and Schmidt-Hebbel [13] argued that this channel works through both the aggregate demand and supply effects. On the demand side, expansionary monetary policy lowers the domestic real interest rate and through the foreign interest parity condition brings about a real depreciation of the domestic currency, resulting in higher net exports and stronger aggregate demand. On the supply side, the ensuing real depreciation following from monetary expansion raises the prices of imported goods in the domestic market thereby raising inflation directly. For developing countries that depend heavily on imported raw materials, the higher price of imported inputs lower the aggregate supply, reducing output and further increasing inflation. The credit channel is another way through which monetary actions transmit to the real sector. The credit channel, as Bernanke and Gertler [14] emphasised, is actually not an independent alternative to the interest rate mechanism but rather an augmenting mechanism consisting of two distinct channels: the bank lending and the balance sheet channels. The bank lending mechanism works through the conditions of supply of bank loans. A tightening of monetary policy that leads first to a contraction in the supply of bank reserves and then to a contraction in bank deposits requires banks that are especially deposits-dependent to cut back on lending and thus reduce the supply of loans for small or medium-sized bank-dependent firms. Such firms are thus forced to search for new lenders and to construct new credit relationships. These costly activities are likely to increase the firms' external finance premium and affect their investment spending decisions. The resultant financial market imperfections faced by individual banks and firms contribute, in the aggregate, to the decline in output and employment that follows a monetary tightening [4,15]. The balance sheet channel refers to the role the financial position of private agents play in the transmission mechanism of monetary policy. It arises because policy changes affect not only market interest rates but also the financial position of private economic agents as changes in interest rates affect bank balance sheets, cash flows and the net worth of firms and consumers. Higher interest rates result in reduced cash flow, reduced net worth, drop in loans, and a decline in aggregate demand [16]. Banks with lower net worth will supply fewer loans under a tight monetary policy or slow economic growth because, in addition to taking insured deposits, they need to raise funds by issuing uninsured debt which is susceptible to agency costs, just as it applies to firms [17].

Considering the various channels, Berg, Charry, Portillo and Vlcek [18] in a case study of four African countries found clear evidence of a working transmission mechanism with the standard features of the transmission mechanism most evident in two of the four countries. They observed that the policy framework makes a big difference in the strength of transmission of policy decisions. For instance, where countries target the monetary base, short-term rates are less likely to be informative or move long-term rates. And when a policy tightening is not accompanied by good communication or a coherent framework it has less clear effects. For instance, Igan, kabundi, Naal de Simone and Tamirisa [19] found strong support for the balance sheet channel of monetary policy transmission for the United States. The authors submit that monetary policy has statistically significant effects on the balance sheets of financial institutions especially banks, issuers of

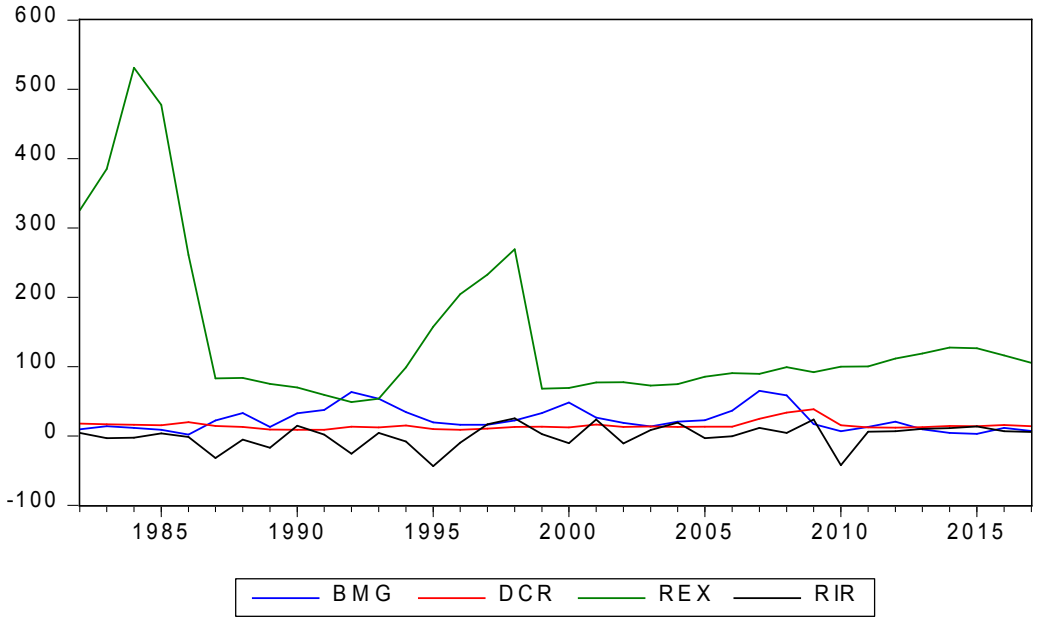

Fig. 1. Trend and interactions of monetary transmission channels

asset-backed securities, and money market funds and, to a lesser extent, on security brokers and dealers. However, the economic significance of monetary policy on the private sector (households' and non-financial firms') balance sheet appears to be less than the effect on the balance sheets of financial institutions. Ndekwa [20] in a study of Nigeria found the monetary policy transmission mechanism to the real sector working through the financial markets via the operations of the interest rate channel, the credit channel, and the exchange rate channel. However, the interest rate effect transmits to the real sector through the credit channel, making the credit mechanism the linchpin in the monetary policy transmission process. This result stands in sharp contrast to Adekunle et al. [21] as well as Adeoye and Shobande [22]. In the former, the authors found the exchange rate channel as the most prevalent mechanism of propagating monetary policy actions, while the latter reported the interest rate as the prime transmission mechanism subject to careful management of the exchange rate. Works on Nigeria provide evidence of a working transmission mechanism but there appears to be no consensus on the dominant channel of transmitting monetary impulse to the real economy.

For this study and following the trend in the literature we select broad money growth (BMG), banks domestic credit to the private sector (DCR), real interest rate (RIR) and real effective exchange rate (REX) to approximate the effect of monetary policy actions on the real sector. A preliminary examination of the trend behavior of the monetary channels is shown in Fig. 1 where the real effective exchange rate showed a higher level of volatility than any of the other three channels. Broad money growth and domestic credit have for the major part stayed closely together demonstrating the least variability of the four channels. Episodes of negative real rate of interest also occurred during the study period.

2. METHODOLOGY

2.1 Data and Model Specification

The source of the data used in this study is the World Bank database from the World Development Indicators (WDI) and relates to the period 1981 to 2017. Annual data on services and manufacturing values added in constant 2010 United States' dollars proxies the real sector and dependent variables in the models to be estimated. The regressors are monetary policy transmission channels to the real sector. Data were obtained for four of such channels based on the literature and data availability. They include the real rate of interest expressed in percentage (RIR), total domestic credit by banks to the private sector expressed as a percentage of the GDP (DCR), broad money annual growth

rate (BMG), and real effective exchange rate (REX). The relationship between monetary policy and the real sector is captured in general terms as a linear expression of the form:

$$y_t = \psi_0 + \psi x_t + \mu_{t,} \quad (1)$$

where y_t is the annual value added of a real sector output and x_t a vector of monetary policy transmission channels. Specifically, we specify two models to answer the main questions of this study. The first operational model captures relationship between monetary actions and the services sector as below:

$$LSVAt = \beta_0 + \beta_1 BMGt + \beta_2 RIRt + \beta_3 REXt + \beta_4 DCRt + e_t \quad (2)$$

Where:

LSVA is the log of services value added, β_0 is a constant term, β_1, β_2, β_3, β_4 are coefficients of the regressors to be estimated, and e_t a random disturbance term. The regressors are as previously defined.

The second operational model also expressed the relationship between monetary actions and the manufacturing sector as a linear function of the form:

$$LMVAt = \eta_0 + \eta_1 BMGt + \eta_2 RIRt + \eta_3 REXt + \eta_4 DCRt + \varepsilon_t \quad (3)$$

Where:

LMVA is the log of manufacturing value added, η_0 is a constant term, η_1, η_2, η_3, η_4 are coefficients of the regressors to be estimated, and ε_t a random disturbance term.

2.2 Econometrics Procedures

2.2.1 Unit root and stationarity tests

In working with time series, it is customary to view time series as the realization of a stochastic process. According to Wei [23], nonstationarity and time-volatility are central properties of many economic time series. However, the classical statistical methods used in building and testing large simultaneous equation models were based on the assumption that the variables involved are stationary. There is thus a problem that the statistical inference associated with stationary processes become invalid if the time series is a realization of nonstationary processes, in which case the t-statistic, F-statistic, etc. do not follow their respective distributions. The weak form of stationarity often applied in most empirical research is present when a time series meets the conditions of the constancy of mean, variance, and autocovariance as in equations 4-6 below:

$$\text{Mean stationarity} \quad E(yt) = \mu \quad (4)$$

$$\text{Variance stationarity} \quad E[(yt - \mu)^2] = \sigma 2 < \infty \quad (5)$$

$$\text{Covariance stationarity} \quad E(y_{t1} - \mu)(y_{t2} - \mu) = y_{t2} - t_1) \text{ for all } t_2 - t_1 \quad (6)$$

To draw valid statistical inference therefore and avoid the pitfall of nonsense regression, it is important to test the data for the existence of unit root or stationarity. If we cannot reject a unit root in levels but do reject a unit root in first differences, the variable in levels contains a unit root or is integrated of order one, I(1). Hence, it needs to be differenced once to render it stationary. If the null hypothesis of a unit root in first differences is rejected, then it may be necessary to test whether the series contains a second unit root [24]. This study will adopt a confirmatory analysis approach where the results of tests with the null hypothesis of unit root are doubled checked using a test of the null of stationarity. For the former, we will apply Ng and Perron's approach [25] in the family of efficient unit root tests and Kwiatkwoski et al.'s approach [26] for the latter. Maddala and Kim [27] posited that using both tests together may be better than using either test alone.

2.2.2 Cointegration test

Having established the stationarity properties of our data we proceed to test for the existence of long-run relationship among the variables. Two series are cointegrated if they are both integrated of order d, I(d), and a linear combination of them has a lower order of integration, (d-b), where b > 0. According to Engle and Granger [28], two non-stationary (first difference stationary) time series, y_t and x_t are cointegrated if there exists a cointegrating vector α that in a linear combination of the two variables yield a stationary disturbance term μt ~ I(0), This study will adopt the ARDL bounds testing approach introduced by Pesaran and Chin [29] and extended by Pesaran, Shin and Smith [30] to investigate the co-integration relationship of the variables. The choice of ARDL is based on its advantages over previously developed co-integration tests, like the residual-

based [28] method and the Full-Information Maximum Likelihood tests [31,32,33]. Different from other techniques, the ARDL bounds testing approach does not require that all the variables under study must be integrated of the same order as it applies excellently to test cointegrating relationship among variables regardless of whether the regressors are integrated of order one I(1), order zero I(0), or fractionally integrated. Also, ARDL employs only a single reduced form equation [29], unlike conventional co-integration methods that estimate cointegration relationship within the context of a system of equations. The ARDL technique generally provides unbiased estimates of the long-run model and valid t-statistics even when some of the regressors are endogenous [34,35]. Finally, ARDL has superior small sample properties when compared to the conventional co-integration test methods.

2.2.3 Coefficients estimation

An ARDL representation of equation (2) and the associated errors-correction representation are given below as equations (7) and (8). The corresponding ARDL representations for equation (3) are equations (9) and (10). Estimating equations (7) – (10) gives the long-run equilibrium coefficients and coefficients of the short-run dynamics for the effect of monetary actions on the services and manufacturing sectors from which our inferences will be made.

$$\Delta LSVA_t = \beta_o + \beta_1 T + \sum_{i=1}^{p} \beta_2 \Delta LSVA_{t-1} + \sum_{i=1}^{p} \beta_3 \Delta BMG_{t-1} + \sum_{i=1}^{p} \beta_4 \Delta RIR_{t-1} + \sum_{i=1}^{p} \beta_5 \Delta REX_{t-1} + \sum_{i=1}^{p} \beta_6 \Delta DCR_{t-1} + \lambda_1 LSVA_{t-1} + \lambda_2 BMG_{t-1} + \lambda_3 RIR_{t-1} + \lambda_4 REX_{t-1} + \lambda_5 DCR_{t-1} \quad (7)$$

$$\Delta LSVA_t = \beta_o + \beta_{1i}^{p} \Delta LSVA_{t-1} + \sum_{i=0}^{p} \beta_2 \Delta BMG_{t-1} + \sum_{i=0}^{p} \beta_3 \Delta RIR_{t-1} + \sum_{i=0}^{p} \beta_4 \Delta REX_{t-1} + \sum_{i=0}^{p} \beta_5 \Delta DCR_{t-1} + \emptyset_i ECM + e_t \quad (8)$$

$$\Delta LMVA_t = \gamma_o + \gamma_1 T + \sum_{i=1}^{p} \gamma_2 \Delta LMVA_{t-1} + \sum_{i=1}^{p} \gamma_3 \Delta BMG_{t-1} + \sum_{i=1}^{p} \gamma_4 \Delta RIR_{t-1} + \sum_{i=1}^{p} \gamma_5 \Delta REX_{t-1} + \sum_{i=1}^{p} \gamma_6 \Delta DCR_{t-1} + \varphi_1 LMVA_{t-1} + \varphi_2 BMG_{t-1} + \varphi_3 RIR_{t-1} + \varphi_4 REX_{t-1} + \varphi_5 DCR_{t-1} \quad (9)$$

$$\Delta LMVA_t = \gamma_o + \gamma_{1i}^{p} \Delta LSVA_{t-1} + \sum_{i=0}^{p} \gamma_2 \Delta BMG_{t-1} + \sum_{i=0}^{p} \gamma \Delta RIR_{t-1} + \sum_{i=0}^{p} \gamma_4 \Delta REX_{t-1} + \sum_{i=0}^{p} \gamma_5 \Delta DCR_{t-1} + \emptyset_i ECM + e_t \quad (10)$$

2.2.4 Diagnostics

The construction of equations (2) and (3) take the assumptions that the transmission of monetary actions to *LSVA and LMVA* through the four regressors are linear in the β and η parameters respectively and that the errors are independent and identically distributed normal random variables with mean zero and constant variance. The diagnostic tests ensure that the assumptions of the regressions are valid so that subsequent inference and conclusions from the results are not faulty. For the residuals normality, serial correlation, and heteroskedasticity test will be performed. The regression assumptions are valid in the results if in each case the p-values of the relevant test statistics are greater than the level of significance of the tests. Lastly, the stability of the models will be interrogated using Ramsey RESET estimates. All tests will be carried out at a 95% level of significance [standard error of 5%].

3. RESULTS AND DISCUSSION

3.1 Unit Root and Stationary Tests

Both tests reported in Panels 1 and 2 of Table 1 are conclusive that each of the models comprise of level and first difference stationary variables.

3.2 ARDL Cointegration Test Results

The results for the F-Bound test for LSVA and LMVA are presented as Tables 2 and 3, respectively. The F-stat at 8.20 is greater than the upper critical bound at 1% and 5% for LSVA suggesting a stable long-run relationship between LSVA and its regressors. A negative and significant cointegration equation (see Table 5) further attest to the existence of a long-run relationship among the variables. A long-run equilibrium relationship was also found for LMVA. The F-stat is greater than the upper critical bound at both 1% and 5%, the cointegration equation (see Table 6) is equally negative and significant. For the two models, the essential requirements for the application of the ARDL estimation framework for both the long-run form and the short-run dynamics are satisfied.

3.3 Long-run Coefficients

For both the services and manufacturing sectors, an expansionary monetary policy measured by broad money annual growth has negative but

significant effect in the determination of value addition in the two sectors. However, broad money growth taking together with the accompanying interest rate and credit effects provide a better explanation that is consistent with theory. An expansionary change in money supply lowers the rate of interest and thus the cost of borrowing, increases the net worth of banks, enhances the lending capacity of banks, and results in higher investment spending by firms and the purchase of consumer durables. This explains the positive and significant effect of both the real interest rate and domestic credit to the private sector on manufacturing and services values added.

With a lower interest rate firms in both sectors can borrow more and expand output through additional investment. Consumers having softer loan terms can also buy more services and durables. Whereas a percentage drop in real interest rate increases services value added by about 5% and manufacturing value added by less than 2%, the credit effect on both sectors is almost the same. In theory, as broad money expands and interest rate falls the exchange rate effect through the foreign interest parity condition brings about a real depreciation of the domestic currency, resulting in higher net exports and stronger aggregate demand. This is not the case in Nigeria. First, the exchange rate effect is negative but insignificant to cause changes in

Table 1. Results of unit root and stationarity tests

Panel 1. Ng-Perron unit result					
Test	MZa	MZt	MBS	MPT	Order of integration
BMG					
Level	-17.4550*	-2.94498*	0.16872*	1.43746*	I(0)
First difference	-	-	-	-	-
RIR					
Level	-17.9419*	-2.98481*	0.16636*	1.40307*	I(0)
First difference	-	-	-	-	-
REX					
Level	-3.94941	-1.35614	0.34338	6.24517	-
First difference	-15.5977*	-2.79176*	0.17899**	1.57405*	I(1)
DCR					
Level	-10.8467**	-2.32752**	0.21458**	2.26379**	I(0)
First difference	-	-	-	-	
LSVA					
Level	-2191.02*	-33.0838*	0.01510*	0.01723*	I(0)
First difference	-	-	-	-	-
LMVA					
Level	0.86900	0.51245	0.58970	27.9665	-
First difference	-16.9555	-2.89840	0.17094	1.49368	I(1)
Critical values 1%	-13.8000	-2.58000	0.17400	1.78000	
5%	-8.10000	-1.98000	0.23300	3.17000	
10%	-5.70000	-1.62000	0.27500	4.45000	

Panel 2: KPSS result			
Variable	**Level**	**First diff**	**Order of integration**
BMG	0.152776	-	I(0)
RIR	0.376523	0.296463	I(1)
REX	0.360247	0.111208	I(1)
DCR	0.175742	-	I(0)
LSVA	0.686570	0.321527	I(1)
LMVA	0.604974	0.341474	I(1)
Critical values			
1%	0.739000		
5%	0.463000		
10%	0.347000		

Table 2. F-Bound test for cointegration

Panel A: *LSVA*		
Test statistic	**Value**	**k**
F-statistic	8.201108	4
Panel B: *LMVA*		
Test statistic	**Value**	**k**
F-statistic	1190.378	4
Critical value bounds		
Significance	**I0 Bound**	**I1 Bound**
10%	2.45	3.52
5%	2.86	4.01
2.5%	3.25	4.49
1%	3.74	5.06

Table 3. Long run coefficients for the services sector

Variable	**Coefficient**	**Std. error**	**t-Statistic**	**Prob.**
BMG	-0.012459	0.006092	-2.044954	0.0655
DCR	0.124547	0.016121	7.725802	0.0000
REX	-0.002622	0.001923	-1.363982	0.1998
RIR	0.048536	0.010603	4.577621	0.0008
C	24.501924	0.428779	57.143543	0.0000

Table 4. Long run coefficients for the manufacturing sector

Variable	**Coefficient**	**Std. error**	**t-Statistic**	**Prob.**
BMG	-0.033236	0.001013	-32.824370	0.0001
DCR	0.127114	0.002039	62.355325	0.0000
REX	-0.001861	0.000286	-6.495078	0.0074
RIR	0.018308	0.001006	18.207299	0.0004
C	22.941800	0.053987	424.952506	0.0000

services value added. In the manufacturing sector, naira depreciation has a significant negative impact on value added. This probably works through the supply side as depreciation of the domestic currency raises the price of imported intermediate and capital goods. A higher net export that expands aggregate demand should provide a countervailing effect to output reduction if Nigeria is a strong exporter of services or manufactures.

3.4 Short-run Coefficients

In the short-run, all the monetary policy transmission channels and their various lags are significant in explaining changes in manufacturing value added. All the lags of broad money growth are positive and significant. Real exchange rate and its lags are also positive and significant except in the third lag, implying that the depreciation of the local currency impacts positively on manufacturing valued added in the short run. The effect of real rate of interest is output reducing up to the third lag. In the services sector, only the real rate of interest is significant in all its entirety on the value added. Domestic credit became a significant factor in services value added only in the fourth lag. The results displayed in Tables 5 and 6 essentially suggests that monetary policy is much effective or significant in inducing changes in the manufacturing sector than the services sector.

3.5 Diagnostics

Panels A and B of Table 7 exhibit three residual test results. The Breusch-Godfrey Serial Correlation LM Test results show that there is no serial correlation as the probabilities of F-Statistic and observed R-square are greater than 5%. The Breusch-Pagan-Godfrey test of heteroskedasticity confirm that the residuals are homoskedastic in the F-Statistic and observed R-square being greater than 5%. In the same vein,

Table 5. Dependent variable: LSVA

Selected model: ARDL(1, 1, 5, 5, 4)				
Cointegrating form				
Variable	**Coefficient**	**Std. error**	**t-Statistic**	**Prob.**
D(BMG)	0.001095	0.000667	1.642077	0.1288
D(DCR)	0.002107	0.002321	0.907858	0.3834
D(DCR(-1))	0.001222	0.002267	0.539147	0.6005
D(DCR(-2))	-0.000086	0.002479	-0.034881	0.9728
D(DCR(-3))	-0.001922	0.002634	-0.729618	0.4809
D(DCR(-4))	-0.004944	0.001990	-2.484885	0.0303
D(REX)	0.000211	0.000248	0.852325	0.4122
D(REX(-1))	0.000469	0.000208	2.250999	0.0458
D(REX(-2))	0.000153	0.000171	0.899204	0.3878
D(REX(-3))	-0.000241	0.000156	-1.550259	0.1494
D(REX(-4))	0.000225	0.000117	1.917300	0.0815
D(RIR)	0.001242	0.000518	2.398156	0.0353
D(RIR(-1))	-0.001364	0.000628	-2.171371	0.0527
D(RIR(-2))	-0.001633	0.000643	-2.538757	0.0275
D(RIR(-3))	-0.001170	0.000588	-1.988422	0.0722
CointEq(-1)	-0.123742	0.025943	-4.769806	0.0006

Table 6. Dependent variable: LMVA

Selected model: ARDL(4, 5, 5, 5, 5)				
Cointegrating form				
Variable	**Coefficient**	**Std. error**	**t-Statistic**	**Prob.**
D(LMVA(-1))	-0.649009	0.024172	-26.849175	0.0001
D(LMVA(-2))	-0.019476	0.019598	-0.993808	0.3936
D(LMVA(-3))	0.193160	0.028489	6.780279	0.0066
D(BMG)	-0.003129	0.000144	-21.685026	0.0002
D(BMG(-1))	0.002789	0.000159	17.576949	0.0004
D(BMG(-2))	0.000555	0.000174	3.199102	0.0494
D(BMG(-3))	0.001243	0.000135	9.237236	0.0027
D(BMG(-4))	0.002532	0.000129	19.565715	0.0003
D(DCR)	0.009770	0.000411	23.784722	0.0002
D(DCR(-1))	0.001967	0.000450	4.366527	0.0222
D(DCR(-2))	-0.008394	0.000630	-13.332007	0.0009
D(DCR(-3))	-0.004329	0.000315	-13.747560	0.0008
D(DCR(-4))	-0.018585	0.000432	-43.006411	0.0000
D(REX)	0.000568	0.000066	8.579167	0.0033
D(REX(-1))	0.000512	0.000027	19.264352	0.0003
D(REX(-2))	0.000693	0.000034	20.121294	0.0003
D(REX(-3))	-0.000236	0.000031	-7.619608	0.0047
D(REX(-4))	0.000271	0.000034	7.930318	0.0042
D(RIR)	-0.000762	0.000088	-8.699974	0.0032
D(RIR(-1))	-0.003065	0.000204	-14.989196	0.0006
D(RIR(-2))	-0.003169	0.000139	-22.772441	0.0002
D(RIR(-3))	-0.002927	0.000109	-26.843400	0.0001
D(RIR(-4))	0.001724	0.000090	19.230005	0.0003
CointEq(-1)	-0.333184	0.009082	-36.686876	0.0000

Table 7. Result of diagnostic tests

Panel A: *LSVA* diagnostics			
Breusch-Godfrey serial correlation LM test			
F-statistic	0.100158	Prob. F(2,9)	0.9057
Obs*R-squared	0.696725	Prob. Chi-Square(2)	0.7058
Heteroskedasticity test: Breusch-Pagan-Godfrey			
F-statistic	0.413335	Prob. F(20,11)	0.9585
Obs*R-squared	13.73013	Prob. Chi-Square(20)	0.8439
Normality test			
Jarque-Bera	**5.303577**	**Probability**	**0.075225**
Ramsey reset test			
t-statistic	1.190298	10 df	0.2614
F-statistic	1.416810	(1, 10) df	0.2614
Panel B: *LMVA* diagnostics			
Breusch-Godfrey serial correlation LM test			
F-statistic	0.017372	Prob. F(1,2)	0.9072
Obs*R-squared	0.275552	Prob. Chi-Square(1)	0.5996
Heteroskedasticity Test: Breusch-Pagan-Godfrey			
F-statistic	0.398901	Prob. F(28,3)	0.9206
Obs*R-squared	25.22475	Prob. Chi-Square(28)	0.6156
Normality test			
Jarque-Bera	**0.1065959**	**Probability**	**0.948099**
Ramsey reset test			
t-statistic	0.787421	2 df	0.5135
F-statistic	0.620031	(1, 2) df	0.5135

the Histogram-Normality test results indicate that the distribution of residuals are normal since the probabilities of the Jarque-Bera statistic is greater than 5%. The Ramsey RESET tests confirm that the estimated models are stable over the study period and good for explaining the effect of monetary policy actions on manufacturing and services values added in Nigeria. These results attest to the validity of inferences drawn from the models as all necessary regression conditions are satisfied.

4. CONCLUSION

This study examined the effect of the monetary policy conducted by the CBN on the manufacturing and services sectors in Nigeria. Two specific objectives were outlined for the study. First, we seek to ascertain if monetary policy has differential effects on the manufacturing and services sectors. Secondly, if the two sectors are influenced in the same way, in which of the sectors is monetary policy more effective for value added expansion. In the long-run, both the money supply and interest rate channels of monetary policy work through the banks domestic credit to influence value-added production in manufacturing and services in Nigeria. While interest rate produces differential results impacting the services sector more than manufacturing, the ultimate effect through the credit channel is almost the same, with manufacturing having a slight value added expansion advantage over services. The effect on value added of depreciation of the exchange rate resulting from lower domestic interest rate is negative for both sectors, though insignificant for services. The implication is that the expected output expansion that should result from aggregate demand growth through increased net export did not take place. This is further reinforced by the high cost of imported raw materials and industrial machinery leading to output contraction. Since the domestic currency value must necessarily fall in response to a lower interest rate relative to international rates, the realization of the full advantage of monetary expansion is possible if both sectors move up the global value chain in manufacturing and services exports. A recent study on services export in Nigeria found Nigeria active only at the low technology, low productivity end of transport and travel services. Nigeria presently holds no share of the more sophisticated business, education, and health-related services export. In transport, exports are exclusively in services auxiliary to all modes of transport with no export representation in the more technology intensive maritime, air,

rail, and pipeline transport services [36]. The gains in output expansion via interest rate and credit expansion was offset, in part, by the debilitating effect of currency depreciation on imported inputs. For a more beneficiary impact of monetary policy on the manufacturing and services sectors, the Nigerian government must urgently undertake a deliberate recreation of the manufacturing environment with particular attention to greater opportunities for local sourcing of industrial raw materials, constant and cheap access to power, and the institution of competitiveness-enhancing frameworks such as a functional national innovation system and export promotion schemes. Since the manufacturing sector is currently dominated by foods and agro-related manufacturing, a functional innovation system should forge a link among agricultural production and industrial raw material needs, industry-focused research, funding of research and diffusion of results, as well as direct research-industry exchanges. The gap to be filled in this respect is a huge one. The exploitation of ample opportunities to participate in high-end tradable services like medical care, education, tourism, shipping, rail, air and pipeline transportation services should be integrated into the nation's industrial master plan while national plans for education and health sectors should deliberately incorporate export orientation.

COMPETING INTERESTS

Author has declared that no competing interests exist.

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