The Effect of Interest Rate On Manufacturing Output in Nigeria: An ARDL Approach.

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ABSTRACT

Availability of capital at low interest rate stands as a sure guarantee to achieve a well-developed manufacturing sector, substantial capital is required either to develop or import technological know-how which is needed for development of the manufacturing sector. This paper, therefore, looks at the effect of interest rate on the manufacturing sector in Nigeria. The study employees ARDL approach involving unit root test, Bound test for co-integration test, short-run and long run test. The unit root test results show that all the series except interest rate are not stationary at levels and the Bound test co-integration test depicts that long run relationships exist among the series. The study uses secondary data covering a period of thirty-eight years from 1981 to 2018. The evidences from the ARDL shows that the effect of Interest Rate (INT) on Manufacturing Output (MQ) in the short run is positive and significant at lag period 1 and it changed to negative in the long run indicating that Interest Rate (INT) is a determinant of Manufacturing Output (MQ)during the period of the study.

Keywords: Interest Rate, Manufacturing Sector, Output, ARDL. Nigeria, Lag Period.

1. INTRODUCTION

The manufacturing sector engages in the physical or chemical transformation of raw materials or substances into new products. Because of its nature and contribution to economic development, in terms of GDP, employment, capital investment and stock, foreign exchange and research and development, the manufacturing sector of an economy is of great importance to any economy both the developed and developing. In Nigeria, given the characteristics and potentials of the manufacturing sector in economic development, the sector is given a crucial role. Consequently, successive development plans and policy statements of the government put the transformation of the manufacturing sector at the centre of Nigeria's growth nexus. The Structural Adjustment Programme (SAP) introduced in May 1986 was partly designed to revitalize the manufacturing sector by shifting emphasis to increased domestic sourcing of inputs through monetary and fiscal incentives. The deregulation of the foreign exchange market was also effected to make non-oil exports especially manufacturing sector more competitive even though, this also resulted in massive escalation in input costs

This dismal performance of the sector in Nigeria could be attributed to massive importation of finished goods and inadequate financial support for the manufacturing sector, which ultimately has contributed to the reduction in capacity utilization of the manufacturing sector in the country (Loto 2012). Availability of capital at low interest rate stands as a sure guarantee to achieve a well developed manufacturing sector, the financial market forms the major source of capital for manufacturing in developing economies. It is pertinent to note that substantial capital is required either to develop or import technological know-how which is needed for development of the manufacturing sector.

The insignificant contribution of the sector to gross domestic product could be as a results of continued deterioration in infrastructural facility as well as lack of access to cheap finance. The growth rate of manufacturing sector in Nigeria has been constrained due to inadequate funding, either due to the inefficient capital market or the culture of the Nigerian banks to finance mainly short term investment. The long term funds from the banking sector are not easily accessible as a result of the stringent and restrictive credit guidelines to the sector as well as high interest rates. All these could be the reason why the Nigerian manufacturing sector has failed to serve as an avenue for increasing productivity in relation to import replacement and export expansion, creating foreign exchange earning capacity, rising employment and per capita income, which causes unique consumption patterns.(Obamuyi, Edun & Kayode ,2010).

The manufacturing sector in Nigeria is faced with the problem of accessibility to funds. Even the financial sector reform of the Structural Adjustment Programme (SAP) in 1986, which was meant to correct the structural imbalance in the economy and liberalize the financial systems did not achieve the expected results (Obamuyi, Edun & Kayode, 2010). As Edirisuriya (2008) reported, financial sector reforms are expected to promote a more efficient allocation of resources and ensure that financial intermediation occurs as efficiently as possible. This also implies that financial sector liberalization brings competition in the financial markets, raises interest rate to encourage savings, thereby making funds available for investment, and hence lead to economic growth (Asamoah, 2008).

Over the years, interest rates have remained a subject for critical assessment with diverse implications for savings mobilization and investment promotion. Generally, interest rates are the rental payments for the use of credit by borrowers and return for parting with liquidity by lenders (CBN, 1997). In the Nigerian economy, the minimum rediscount rate (MRR) now monetary policy rate (MPR) is the official interest rate of the Central Bank of Nigeria (CBN), which anchors all other interest rates in the money market and the economy (Ogunbiyi & Ihejirika, 2014). In August, 1987 the CBN liberalized the interest rate regime and adopted the policy of fixing only its minimum rediscount rate to indicate the desired direction of interest rate.

This was modified in 1989when the CBN issued further directives on the required spreads between deposit and lending rates. In 1991, the government prescribed a maximum margin between each bank's average cost of funds and its maximum lending rates. Later, the CBN prescribed savings deposit rate and a maximum lending rate. The removal of the maximum lending rate ceiling in 1993 saw interest rates rising to unprecedented levels in sympathy with rising inflation rate which rendered banks' high lending rates negative in real terms (Ogunbiyi & Ihejirika, 2014). In 1994, direct interest rate controls were restored. As these and other controls introduced in 1994 and 1995 had negative economic effects, total deregulation of interest rates was again adopted in October, 1996.

However, all the regulations and deregulations of interest rate in Nigeria were all in a bid to manage the country's capital allocation through the financial sector. The essence of managing interest rates were based on the premise that the market, if freely allowed to determine the rate of interest would exclude some priority sectors. Thus, interest rates were adjusted through the "invisible hand" in order to promote increased level of investment in the various preferred sectors of the economy. Prominent among the preferred sectors were the agricultural, manufacturing and solid mineral sectors which were accorded priority and deposit money banks were directed to charge preferential interest rates on all loans to encourage the upsurge of small-scale industrialization which is a catalyst for economic development (Udoka and Roland, 2012). Thus, this study therefore examines the effect of interest rates on the performance of the Nigerian manufacturing sector.

2. LITERATURE REVIEW

2.1 Conceptual Issues/ Clarification

The crucial role of capital in the economic growth and development process had been recognized that without doubt, every nation in the world today still lay tremendous emphasis on capital accumulation by stressing the need for raising the level of investment in relation to output. This emphasis is traceable to the short term fiscal policies and national development plans of both the developed and the developing economies over the past four decades. One important trend in developmental process which has remained consistent since civilization is that, all developed Nations are industrialized (Udoka & Roland, 2012). Industrialization is associated with heavy investments financed through capital accumulation. Rapid and sustainable real economic growth is a necessary condition for economic development. Meanwhile, for growth to occur there is the need for a relatively stable macro-economic environment which is an indicator for low risk and a condition for attracting investment and boosting entrepreneurial activities. Even though a certain level of lending interest rate and inflation may be important in attracting investment. There is therefore the need to keep lending interest rate and inflation at a manageable limit in order to propel economic growth. The macro-economic policy formulation challenge confronting many developing countries today is how to achieve a single digit inflation, manageable trade and balance of payments deficits and higher savings and investments rates to finance long term economic growth.

In Nigeria, interest rate is determined by the following factors:

(i)   The investment demand: The higher the level of investment demand the higher the level of interest rates. On the other hand, the lower the investments demand, the lower the level of interest rates.

(ii)   The level of savings (or conversely the level of consumption): The higher the level of savings the lower the interest rate while, the borrower the level of savings, the higher the level of interest rates,

(iii)   Demand for money or the liquidity preference: The higher the money demand, the lower the interest rate while the lower the money demand the higher the interest rates,

(iv)   The quantity of money or money supply: In the Keynesian parlance as we increase money supply the interest rate will reduce.

Capacity utilization is a concept in Economics, which refers to the extent to which an enterprises or a nation actually uses its installed productive capacity (Adeyemi & Olufemi, 2016). Thus, it refers to the relationship between actual output produced and potential output that could be produced with installed equipment if capacity was fully used. Capacity utilization in industry is described as the level of utilization of an industry's installed productive capacity. An industry would be said to be performing optimally when its installed production capacity is fully utilized. By contrast, in the cost approach, capacity output is an optimum level of output at which an additional unit of output would well exceed the output range.

2.2 Theoretical Review

Macroeconomists have established the theoretical relationship between real output and monetary policy measures. In contrast to Keynesian policy prescription, McKinnon (1973) and Shaw (1973) in there hypothesis by channelling saving to productive investment and stimulate real output growth such as the manufacturing sector. Udoka and Roland (2012) notes that there is a large body of literature on interest rate management. The important ones are the classical, the loanable funds, the Keynesian and the modern theory of interest. The classical theory posits that, rate of interest is determined by the supply and demand for capital by the expected productivity of capital. Both time preference and productivity of capital depend upon waiting or saving or thrift. The theory is also known as the supply and demand theory of savings (Udoka and Roland, 2012).

The Keynesian liquidity preference theory determines the interest rate by the demand for and supply of money in a stock theory. It emphasizes that the rate of interest is purely a monetary phenomenon. It is a stock analysis because it takes the supply of money as given during the short run and determines the interest rate by liquidity preference or demand for money.

On the other hand, the loanable funds theory is a flow theory that determines the interest rate by the demand for and supply of loanable funds. It involves the linking of interest rates with savings, dishoarding and bank money on the supply side. However, this work is anchored on the Keynesian theory. According to the Keynesians school of thought, a discretionary change in money supply permanently influences real output by lowering the rate of interest and through the marginal efficiency of capital, stimulate investment and output growth (Athukorala, 1998).

2.3 Theoretical Framework

The linkage between interest rate and manufacturing sector is recognized in the literature on growth can be traced to the Keynesian investment theory (1936) and Mackinnon (1973) and Shaw (1973) saving and investment hypothesis. The Keynesian theory postulates that low interest rate as a component of cost administered is detrimental to increase savings and hence investment demand. Keynesian theory emphasize that the rate of interest is a purely monetary phenomenon as distinct from the real theory of the classics. Keynes theory places emphasis on the importance of interest rates in investment decisions. Changes in interest rates should have an effect on the level of planned investment undertaken by private sector businesses in the economy. A fall in interest rates should decrease the cost of investment relative to the potential yield and as result planned capital investment projects on the margin may become worthwhile.

On the other hand, Mckinnon (1973) and Shaw (1973) argue that increase in the real interest rate will have strong positive effects on savings which can be utilized in investment, because those with excess liquidity will be encouraged to save because of the high interest rate, thus banks will have excess money to lend to investors for investment purpose thereby raising the volume of productive investment. The empirical works of Mckinnon (1973) showed evidence to support the hypothesis that interest rate determine investment. The critical question, therefore, is whether rising lending interest rates have any positive effect on manufacturing sector performance in Nigeria. This research paper, hereby, utilizes these theories as the main theoretical framework of this research analysis.

2.4 Empirical Review of Cases In Developing Countries

Odhiambo (2009) examined the effect of interest rate liberalization on economic growth in Zambia. Regression results show evidence of a strong support for positive impact of interest rate on financial deepening. He also finds that financial deepening granger-causes growth. Other findings of the study are (i) lagged financial depth leads to further financial depth (ii) bi-lateral causation exist between savings and growth (iii) financial development has long-run causation on savings.

Khat and Bathia (1993) used non-parametic method in his study of the relationship between interest rates and other macro-economic variables, including savings and investment. In his study he grouped (64) Sixty-Four developing countries including Nigeria into three bases on the level of their real interest rate. He then computed economic rate among which were gross savings, income and investment for countries. Applying the Mann - Whitny test, he found that the impact of real interest was not significant for the three groups.

Rioba (2014), studied the importance of manufacturing industry for the economic growth of Kenya economy from Kaldorian perspective. The study utilized a time series data covering 1971 – 2013. The study employed real GDP growth rate as the dependent variable and manufacturing output growth rate; Non-manufacturing output growth rate; manufacturing employment growth rate. The data obtained were analysed using ordinary least square method. The study found that there exist a positive relationship between manufacturing production and economic growth in Kenya but the relationship is weak to spur up increased growth.

Adugna (2014), examined the impact of manufacturing sector on economic growth in Ethiopia based on Kaldorian approach. The study used a time series data covering 1980 – 2010. The study employed real gross domestic product (RGDP) as the dependent variable and manufacturing sector output (mf); manufacturing number of employment (emp); and labour productivity in the manufacturing sector (lpdrt) as the independent variables. The data obtained were analysed using both descriptive (ration and percentage) and econometrics (double log multiple regression analysis) method. The study found that a unit change in manufacturing sector increases the economic growth by 42 percent, that is, the higher growth of the manufacturing sector can have multiple impact on the national economy.

2.5 Empirical Review of Cases In Nigeria

Erinma (2016) examined the effect of rising interest rates on the performances of the Nigerian manufacturing sector. Data for the study spans thirty five (35) years covering 1981 to 2015. The models were analyzed using the ordinary least squares. Findings from the study shows that rising interest rate in Nigeria has a negative effect on the contribution of the manufacturing sector to GDP as well as on the average capacity utilization of the Nigerian manufacturing sector. This implies that the rising interest rate in Nigeria impedes the activities and the performances of the Nigerian manufacturing sector.

Onakoya (2018) examined the impact of the changes in the macroeconomic factors on the output of the manufacturing sector in Nigeria from 1981 to 2015. Preliminary evaluation of the data was conducted using both descriptive statistics and stationarity evaluation. The test indicated that not all the variables are normal. The occurrence of order integration at first level difference necessitated the deployment of the Johansen cointegration test. The findings revealed no short run association among manufacturing output and each of GDP, exchange rate, broad money supply and unemployment rate. Negative relationship existed amongst inflation rate, interest rate, exchange rate, broad money supply on one hand, and manufacturing output. The inflation rate and interest rate, were statistically insignificant.

However, significant and positive relationship existed between GDP of the previous year and unemployment on the one hand and manufacturing output on the other, at 5 percent level. The results showed that manufacturing was a veritable engine of economic growth.

Adeyefa and Obamuyi (2018) investigated the effect of financial deepening on the performance of manufacturing firms in Nigeria from 1970 to 2016. The data were sourced from the Central Bank of Nigeria Statistical Bulletin and the National Bureau of Statistics. The model was specified, and the hypotheses were tested with the Autoregressive Distributed Lag model and Mann-Whitney U Test test. The Augmented Dickey-Fuller, Phillips-Perron and Breusch-Pagan-Godfrey tests were carried out to ensure robust regression results. Results obtained from the study revealed that broad money supply has direct and significant impact on index of manufacturing production (p-value= 0.0039) in Nigeria, credit to private sector has indirect and insignificant impact on index of manufacturing production (p-value= 0.1167) in Nigeria and market capitalization has an indirect and significant impact on index of manufacturing production (p-value= 0.0051) in the long-run and a direct and insignificant impact (p-value= 0.1596) in the short-run. The study also discovered that financial deepening impacted more on the manufacturing sector performance in the post-financial reforms period.

Ebele and Loremba (2016) examined the effect of commercial bank credit on the manufacturing sector output in Nigeria from 1980 to 2015 using Cochrane-Orcutt method. Five variables of manufacturing sector output, inflation rate, interest rate, loans and advances and broad money supply were used for the study. The variables were tested for unit root using the Augmented Dickey Fuller approach and were found to be stationary at levels. The study found that, inflation rate and interest rate have negative effect on manufacturing sector output while loans and advances and broad money supply have positive effect with manufacturing sector output in Nigeria.

Ogar, Basil and Gbenga (2018) investigated the relationship between interest rate and the manufacturing sector performance in Nigeria from the period 1981-2016. The wide interest rate spread and the irregular contribution of manufacturing sector to Gross Domestic Product in Nigeria necessitated this study. The study employed time series secondary data which were sourced from the central bank of Nigeria (CBN) statistical bulletin. The study applied several estimation techniques such as unit root to test for the stationarity, the Johanson cointegration test to verify long run association among the series and the vector error correction model as a verification of the short run adjustment. The results established the existence of a long run relationship among the variables, the results equally confirmed a negative but significant relationship between lending rate and manufacturing output in Nigeria. A positive but insignificant relationship between deposit rate and the manufacturing sector output was observed. Short run association between the variables was equally recorded.

Nwokoro (2017) investigate the impact of Foreign Exchange and Interest Rates variations on the Nigeria"s manufacturing Output during the period 1983 to 2014. The study employed the Ordinary Least Square (OLS), stationarity, co-integration, together with Error Correction Modelling, to know the significance and relationship between Foreign Exchange Rate, Interest Rate, Capacity Utilization, Government Expenditure on Manufacturing Sector, Investment in Industrial production and Manufacturing Output in Nigeria within the period under review. All the variables were stationary at first difference and there also exists equilibra relationships between the regressand and the explanatory variables. All the regressors (explanatory variables) appeared in their right signs according to apriori expectation being that Foreign Exchange Rate (FREX) and Interest Rates (INTR) have negative but significant relationship with manufacturing Output

Okoye, Nwakoby and Modebe (2015) examines the extent to which movements in lending or loan rate and its major determinants like exchange rate, inflation rate and financial depth (independent variables) account for the trend in output performance of Nigeria's industrial sector (dependent variable). Annual data on the variables, sourced from the publications of the Central Bank of Nigeria, were analyzed using the analytical technique of the vector error correction model (VECM). The study shows that exchange rate volatility has an insignificant positive impact on industrial output performance. It also shows evidence of significant positive impact of lending rate and financial depth on industrial output growth. However, evidence from the study shows that inflation has a significant negative effect on the output of the sector.

Osmond, Egbulonu and Emerenimi (2015) examines the impact of monetary policy variables on manufacturing in Nigeria from 1981 – 2012. The theoretical relationship between monetary policy variables and manufacturing sector (that is, the real sector) was critically examined and established in this study. Hence, the researcher specified four explanatory variables for this study based on theoretical underpinnings. The Johansen cointegration test was employed in order to establish long run equilibrium relationship between the explained and the explanatory variables. The error correction model (ECM) was employed to estimate the model. The study revealed that money supply and credit to private sector exert tremendous influence on manufacturing in Nigeria.

Adebiyi and Obasa (2004) investigate the impact of interest rates and other macroeconomic factors on manufacturing performance in Nigeria using cointegration and an error correction mechanism (ECM) technique with annual time series covering the period between 1970 and 2002. Some statistical tools are employed to explore the relationship between these variables. The analysis starts with examining stochastic characteristics of each time series by testing their stationarity using Augmented Dickey Fuller (ADF) test.

Then, the study estimates error correction mechanism (ECM) model. From the error correction model, several interesting conclusions are drawn from the study. First, interest rate spread and government deficit financing have negative impact on the growth of manufacturing sub-sector in Nigeria. Secondly, the study empirically reveals that liberalization of the Nigerian economy has promoted manufacturing growth between 1970 and 2002. Lastly, the findings are further reinforced by the presence of a long-term equilibrium relationship, as evidenced by the cointegration, and stability in the model.

3. METHODOLOGY

This paper rests on Keynesian investment theory (1936) and Mackinnon (1973) and Shaw (1973) saving and investment hypothesis.

This paper also adapted the work of Erinma (2016) with a little modification. The main method of analysis employed in this study is the Auto-Regressive Distributed Lag model (ARDL).The choice of this approach is informed by the need to investigate the short run and long run impact of rising interest rate on manufacturing sector in Nigeria. Prior to the error correction analysis, the time series properties and cointegrating relationships among the variables are examined using Augmented Dickey Fuller (ADF) and Phillip Peron(pp) so as not to end up with a spurious regression.

3.1 Model Specification
MQ =f (INT, INV, RER, GDP)
InMQ = $a_0 + a_1$INT + a_2InRER + a_3InINV + a_4InGDP + U
Where MQ = Manufacturing Sector Output captured by Manufacturing Capacity
Utilization, INT= Prime Lending Rate,
INV= Private Sector Investment,
RER= Exchange rate and
GDP= Gross Domestic Product

3.2 Sources of Data
The data used are secondary data and spans for a period of thirty eight years covering 1981 to 2018. The data were obtained from the Central Bank of Nigeria 2018 statistical bulletin and World Bank Development Indicator

4. DATA ANALYSIS

4.1 Descriptive Analysis
In the summary statistics presented in Table 1, Manufacturing Output (MQ)takes valuebetween29.29% and 73.30% with an average value of 47.22%. Interest Rate (INT), ranges from 7.75% to 29.80%and on the average, the value stood at17.58%. Investment (INV) hovers around N5, 668.87million and N15, 789.67million with an average N8, 498.09million. Real Exchange Rate (RER)takes a minimum rate of 50.17 and maximum of 541.46. However, the average of the series is150.45.For GDP, the average value during the years stood at N35, 384.23millionwith minimum and maximum values of N16, 211.49million and N70, 546.10million respectively.

Table 1: Summary Statistics

	MQ	INT	INV	RER	GDP
Mean	47.22	17.58	8,498.09	150.45	35,384.23
Median	49.95	17.54	8,111.33	100.51	24,823.10
Max.	73.30	29.80	15,789.67	541.46	70,546.39
Min.	29.29	7.75	5,668.87	50.17	16,211.49
Std.	10.65	4.63	1,980.14	121.23	18,788.69
Obsn	38	38	38	38	38

Source: *Author's Computation, underline data from CBN Statistical Bulletin and World (Bank) Development Indicator database, 2019.* **Note**: *The variables are MQ = Manufacturing Output, INT = Interest Rate, INV = Investment, RER = Real Exchange Rate and GDP = Gross Domestic Product. Unit Root Test*

To check the time series property of the selected variables in this study, Augmented Dickey Fuller (ADF) and Phillip Peron (PP) Unit Root tests were conducted at levels and first difference and the results are presented in Table 2.The result shows that all the tests reject the null hypothesis of unit root (non-stationarity) except that of interest rate. As suggested by the two most frequently used unit root test approach, we are having a mixture of I(0) and I(1).

That is Interest rate (INT) is integrated of order zero while all other variables are integrated of order one highlighting the need to check if a long-run relationship exists among these variables using a Bound Test cointegration test.

Table 2: Unit Root Test

Variable	@level	@ 1st Diff.	Order of Integration
	Augmented Dickey-Fuller (ADF)		
Log(MQ)	-2.053 (0.264)	-3.702*** (0.008)	I(1)
INT	-3.523** (0.013)	-9.559*** (0.000)	I(0)
Log(INV)	-2.205 (0.208)	-4.874*** (0.000)	I(1)
RER	-2.019 (0.278)	-4.170*** (0.002)	I(1)
Log(GDP)	-0.534 (0.872)	-4.136*** (0.003)	I(1)
	Phillips-Perron (PP)		
Log(MQ)	-2.212 (0.206)	-3.618** (0.010)	I(1)
INT	-3.484** (0.014)	-9.658*** (0.000)	I(0)
Log(INV)	-3.505 (0.013)	-5.443*** (0.000)	I(1)
RER	-1.907 (0.326)	-4.119*** (0.003)	I(1)
Log(GDP)	-0.818 (0.993)	-3.809*** (0.006)	I(1)

*Source: Author's Computation, underline data from CBN Statistical Bulletin and World (Bank) Development Indicator database, 2019. **Note**: The variables are MQ = Manufacturing Output, INT = Interest Rate, INV = Investment, RER = Real Exchange Rate and GDP = Gross Domestic Product. *** represents $p<0.01$, represents ** $p<0.05$ and represents * $p<0.1$*

4.2 Co integration test
Following the ADF and PP unit root results in Table 2, ARDL bounds test approach to cointegration is employed to investigate the presence of long-run relationships among the variables. The lower and upper bounds on the critical values for the asymptotic distribution of the test statistic were supplied by Pesaran et al. (2001). In this case, the lower bound is based on the assumption that all of the variables are I(0) while the upper bound is based on the assumption that all of the variables are I(1). From the result in Table 3, the computed F-statistic value (5.933) exceeds the upper critical bound values (5.06) suggesting that the null hypothesis of no cointegration can be safely rejected at 1% significance level. Thus, we conclude that there is cointegration.

Table 3: F-Bounds Test

Signif.	*I(0)*	*I(1)*	*F-statistic*
10%	2.45	3.52	
5%	2.86	4.01	
2.5%	3.25	4.49	5.933
1%	3.74	5.06	

Source: *Author's Computation, underline data from CBN Statistical Bulletin and World (Bank) Development Indicator database, 2019.*

4.3 Short-run and Long-run Models
To investigate the effect of exchange rate on manufacturing sector in Nigeria, this study employed Autoregressive distributed lag (ARDL) approach. This is because all the variables are not integrated of the same order. In this model, the dependent variable is Manufacturing Output (MQ) while the independent variables are Interest Rate (INT), Investment (INV), Real Exchange Rate (RER) and Gross Domestic Product (GDP), their lags and lag of Manufacturing Output are used as independent variables. In Table 3 we present the result of the ARDL with maximum lag period of 2 as guided by AIC. Based on the result, the speed of adjustment, (CointEq(-1)), which captures the rate at which the system, adjusts to the equilibrium state after a shock appears to be -0.375. As expected, this value shows a negative sign, and is less than unity, an indication that the model converges towards equilibrium.

Interpreting the coefficients, in the short-run, the coefficient of Interest Rate (INT) at lag period 1 is positive and statistically significant at 5% level [β = 0.0066; P – value = 0.027] indicating that one unit increase in INT(-1) causes Manufacturing Output (MQ) to increase by 0.66% percent in the short-run. However, this relationship isn't the same in the long-run. This is because the long run results shows that negative and significant relationship exists between current value of Interest Rate (INT) and Manufacturing Output (MQ) at current period at 5% levels [β = -0.0197; P – value = 0.021]. This depicts that in the long-run, an increase in INT would result in 2.1% decrease in Manufacturing Output (MQ). Furthermore, other explanatory variables (lag of Investment (INV) and Gross Domestic Product (GDP)) at current or past periods show significant relationships with Manufacturing Output (MQ) in the short run at different levels of significance. These result however, except investment (INV) remained the same in the long run as all these variables show significant relationships with Manufacturing Output (MQ). These mean that Real Exchange Rate (RER) and Gross Domestic Product (GDP) are determinants of Manufacturing Output (MQ) in the long run.

16

4.4 Diagnostic Tests

The F- statistic = 9.517 (P –value = 0.000) and R-squared = 0.704 confirm the usefulness of the model. Besides, to check the residual (error term) of the estimated model for normality, the study reports Jarque-Bera statistic for normality in Table 4. Also, Breusch-Godfrey Serial Correlation LM Test with the null hypothesis of no serial correlation is applied to validate the model. To check whether the selected model in this study possesses heteroskedasticity or not, the study employed Breusch-Pagan-Godfrey. From the Table, all the test statistics and their associated p-values are statistically insignificant. These mean that the residual is normally distributed, free from serial correlation problem and has constant variance. Therefore, we conclude that the model is fit.

Table 4: Short-run and Long-run Models

Variable	Coefficient	Std Error	t-Stat.	Prob.
	Short Run Coefficients			
C	-0.2581	0.0373	-6.9185	0.0000
D(INT)	0.0035	0.0028	1.2269	0.2318
D(INT(-1))	0.0066**	0.0028	2.3522	0.0272
DLOG(INV)	-0.1322	0.0837	-1.5802	0.1272
DLOG(INV(-1))	-0.2328***	0.0813	-2.8629	0.0086
DLOG(GDP)	0.6482**	0.2620	2.4736	0.0208
DLOG(GDP(-1))	1.0599***	0.2917	3.6334	0.0013
CointEq(-1)*	-0.3751***	0.0638	-5.8830	0.0000
	Long Run Coefficients			
INT	-0.0197**	0.0080	-2.4628	0.0213
LOG(INV)	0.3684	0.2651	1.3896	0.1774
LOG(RER)	-0.1743***	0.0574	-3.0337	0.0057
LOG(GDP)	0.2102*	0.1028	2.0455	0.0519
R^2	0.704			
Adj. R^2	0.630			
F-Statistic	9.517			
Prob.(F-Stat)	0.000			
	Post Estimation Tests			
Durbin-Watson	2.16			
Normality Test (P-Value)	1.015 (0.602)			
Serial Correl. LM Test (P-Value)	1.296 (0.302)			
Heteroskedasticity Test (P-Value)	1.324 (0.2717)			

Source: *Author's Computation, underline data from CBN Statistical Bulletin and World (Bank) Development Indicator database, 2019*. **Note**: *The variables are MQ = Manufacturing Output, INT = Interest Rate, INV = Investment, RER = Real Exchange Rate and GDP = Gross Domestic Product. *** represents p<0.01, represents ** p<0.05 and represents * p<0.1*

5. SUMMARY OF FINDINGS

The study investigates the effect of Interest rate on manufacturing sector in Nigeria, using time series data within the period 1981to 2018. The study employed ARDL approach involving unit root test, Bound test for co-integration test, short-run and long run test. The unit root test results show that all the series except interest rate are not stationary at levels and the Bound test co-integration test depicts that long run relationships exist among the series. The evidences from the ARDL shows that the effect of Interest Rate (INT) on Manufacturing Output (MQ) in the short run is positive and significant at lag period 1 and it changed to negative in the long run indicating that Interest Rate (INT) is a determinant of Manufacturing Output (MQ)during the period of the study. This conforms with previous study by Ogar, Basil & Gbenga (2018).

Furthermore, we found evidences that lag of Investment (INV) and Gross Domestic Product (GDP) at current and past period are significant driver of Manufacturing Output in the short run. However, these changed in the long run where all these variables at current period except Investment (INV) have significant relationships with Manufacturing Output (MQ).

6. CONCLUSION AND RECOMMENDATION

This study looked at the impact of interest rate on the manufacturing industry of Nigeria. It also examined the long run relationship among the specified variables. The main method of data analysis employed in this study is Auto Regressive Distributed Lag model (ARDL). Prior to the ARDL analysis, the time series properties and cointegration relationships among the variables were examined using Augumented Dickey Fuller and Phillips Peron tests. The result shows that interest rate have positive and significant relationship with Manufacturing output in the short run while it has a negative relationship with it in the longrun. In order for credit to be easily accessible by the manufacturing sector, the Government should instruct financial institutions to reduce the interest charged on loans given to manufacturers. Also the Government establish more specialised banks for this sector, so that manufacturers can access loans from there at reduced interest rate.

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