International Journal of Business, Economics and Management
2018 Vol. 5, No. 4, pp. 94-103
ISSN(e): 2312-0916
ISSN(p): 2312-5772
DOI: 10.18488/journal.62.2018.54.94.103

AN INVESTIGATION OF THE RELATIONSHIP BETWEEN MANUFACTURING OUTPUT AND ECONOMIC GROWTH : EVIDENCE FROM NIGERIA'S DATA SET

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Article History
Received: 29 June 2018
Revised: 21 August 2018
Accepted: 4 September 2018
Published: 25 September 2018

Keywords
Manufacturing output
Economic growth
Cointegration
Error correction
Granger causality
Nigeria.

JEL Classification:
D24; O4; C22.

ABSTRACT

This paper examined the relationship between manufacturing output and economic growth using Nigeria's data set for empirical testing. The study adopts cointegration technique, error correction mechanism and granger causality test to investigate the long run, short run dynamics and causal relationship between manufacturing output and economic growth. The key variables employed in the estimation are technology, domestic investment, lending rate to private investors, foreign direct investment inflows, capacity utilization rate, foreign exchange rate and price movement. The cointegration tests suggests that long run relationship exists among the variables employed in the estimation. Findings from the long run and short run estimation shows that gross fixed capital formation, capacity utilization rate, foreign direct investment inflows, price movement, technology and lending rate to private investors are credible determinants of manufacturing output in Nigeria. The causality test suggests a unidirectional relationship between economic growth and observed manufacturing output. Policy direction is instructive towards achieving sustainable industrial growth and development.

Contribution/Originality: This study contributes to the existing literature by pooling together all the credible variables identified as determinants of manufacturing output and also establish the relationship between economic growth and manufacturing output in Nigeria. The study uses new econometrics techniques to analyze the variables used in the model and also originates new formula for generating observed manufacturing output in Nigeria.

1. INTRODUCTION

Over the past few years, there has been increasing attention on how manufacturing output could be used as an additional revenue base and industrialization ladder in the process of concretizing economic growth in Nigeria. This perception came up following the abysmal and epileptic performance of agriculture and oil sector[1]. The literature, however documented the pivotal role played by the manufacturing sector as lubricating engine of growth with apparent positive spill over in terms of making available varieties of consumable goods and services, open window for employment opportunities and alleviation of poverty. Manufacturing output has been proven to be less

[1]. With the systematic relegation of Agricultural sector (which contributed over 60% of the GDP), Crude Oil suddenly emerged in the early 80s as credible sector supporting the revenue base of the government. In the 80's, crude oil price crashed in the international oil market. This impacted negatively on the oil producing countries domestic macroeconomic variables stability.

susceptible to external shocks compared to primary commodities whose income demand elasticity is relatively low, with price, prone to market volatility. Confronting the performance of manufacturing output and economic growth in Nigeria with statistical data showed that manufacturing output recorded insignificant contribution to the GDP compared with some selected sectors such as agriculture and oil.

Shortly after the independence in 1960 and for much of the decades, agriculture continues to be the major fulcrum which the economy revolves on, accounting for about 57% of the GDP. Agriculture share in the GDP stood at 30% during the period 1970-1979. It climbed from 31.2% to 41.6% during the period 1980-1989 and 2010-2017 respectively. The decline in agriculture share could be attributed to perpetual neglect and discovery of crude oil. In contrast, the manufacturing output share in the GDP during the period 1960-1969 stood at 6.53%. It recorded a marginal increase of 6.63% during the period 1980-1989. Manufacturing contribution in GDP declined from 5.07% to 4.44% during the period 1990-1999 and 2010-2017 respectively. The oil sector share in GDP during 1960-1969 stood at 3.0%. It increased sharply from 19.3% to 33.9% during 1970-1979 and 1990-1999, and later declined to 10.6% during the period 2010-2017[2]. The decline could be linked to the global fluctuations in oil prices in the international market.

There is need to note that modern manufacturing processes are branded by high technological innovations, quality managerial and technical skills cum entrepreneurial talents. The combinations of these factors possesses growth potentials on industrial output and better living standards. In view of this, governments in Nigeria have initiated series of policy measures towards ensuring vibrant manufacturing activities which could result into larger industrial output. The policy thrust of government over the past few years include: import substitution strategy specifically to cut down import dependent inputs. This policy was designed to preserve foreign exchange committed to foreign inputs. Restrictive monetary policy and stringent exchange control measures was also initiated to boost manufacturing output in Nigeria. In order to firmly reinforce the effectiveness of these policies, the Structural Adjustment Policy (SAP) was introduced to restructure the consumption and productive patters of the economy. Despite the policy measures, the manufacturing output has progressively declined due to weak technological base, poor entrepreneurial skills, insufficient capital base and inadequate infrastructural support.

Empirical studies proliferate in the literature explaining the relationship between manufacturing output performance and economic growth in Nigeria. Chukwuedo and Ifere (2017) examined the relationship between manufacturing output and economic growth using time series data which spanned the period 1981-2013. An eclectic model which combined Kaldor's first law of growth and endogenous growth was estimated. Findings from the study indicated that manufacturing output, capital and technology are the critical determinants of economic growth. The study further confirmed negative and insignificant relationship between institution's quality and labour force on economic growth. Ogunmuyiwa *et al.* (2017) investigated the impact of bank credit on growth of the manufacturing output in Nigeria using time series data which spanned the period 1999-2014. Within the context of the Autoregressive Distributed Lag (ARDL) framework, empirical findings showed that bank credit channelled to the private sector has positive influence on the manufacturing output. Olamade and Oni (2016) examined the relevance of manufacturing output on economic growth by testing Kaldor's first law of economic growth using panel data for a sample of 28 African countries over the period 1981-2015. Empirical findings obtained from pooled Ordinary Least Squares, Fixed Effects, and System Generalized Method of Moments suggested that the share of manufacturing output in the GDP, however, positive but significant. Ajudua and Ojima (2016) used Johansen Cointegration technique and Granger causality test to analyze the long run and causal relationship between manufacturing output and economic growth in Nigeria during the period 1986-2014. In the estimation, gross capital formation, bank credit to manufacturing sector, lending rate, employed labour force, foreign direct

[2]. The evidence provided here in respect of the share of manufacturing, agriculture and oil sector share in the GDP were computed from the Central Bank of Nigeria's Statistical Bulletin, various issues. The estimates are available if in doubt.

investment, capacity utilization rate and foreign exchange rate are used as independent variables while manufacturing output used as dependent variable. Empirical findings indicated that bank credit, foreign direct investment, capacity utilization rate, and foreign exchange rate negatively influenced manufacturing output, while employed labour force, gross capital formation and lending rate positively influenced manufacturing output in Nigeria. Adofu *et al.* (2015) also conducted an empirical study on the relationship between manufacturing output performance and economic growth in Nigeria using data point 1990 to 2013. The OLS method was employed to ascertain the relationship between manufacturing output, its components and economic growth. The results pointed a negative and insignificant relationship between manufacturing output and real gross domestic product growth (proxied economic growth).

Bennett and Anyanwu (2015) studied the effect of industrial development on the economic growth in Nigeria between 1973-2013. The variables employed in the estimation include: GDP (dependent variable), foreign direct investment, industrial output, total savings and inflation (independent variables).Under the econometric procedure of OLS, findings from the estimation showed that industrial output negatively influenced economic growth, though not statistically significant. Savings and net foreign direct investment positively influenced growth while inflation rate negatively related with economic growth. Afaha and Olugundudu (2014) empirically investigated the macroeconomic factors affecting industrial performance in Nigeria during the period of 1979-2010 by employing co-integration and an error correction model. The study showed that, interest rate spread and exchange rates have negative impact on the growth of manufacturing sub-sector in Nigeria. Olorunfemi *et al.* (2013) employed panel data analysis to investigate the performance of manufacturing output on GDP during the period 1980-2008. The OLS results indicated positive relationship between manufacturing output and capacity utilization rate, while investment, exchange rate, and exports negatively influenced manufacturing output. Simon-Oke and Awoyemi (2010) investigated the impact of manufacturing capacity utilization on industrial development in Nigeria during the period 1976-2005. Manufacturing capacity utilization, value added and employment generation were regressed on index of industrial productivity (proxy for industrial development) using the co-integration and error correction mechanism as analytical tools. The econometric evidence confirms that there is a long run positive relationship between manufacturing capacity utilization, value added and index of industrial productivity in Nigeria. Salami and Kelikume (2011) employed quarterly time series data to estimate the linkage between the manufacturing sector and other sectors of the Nigerian economy with the aid of Granger causality test and Vector auto regression method during the period 1986-2010. Findings from the estimation showed a weak linkage between manufacturing output and other sectors of the Nigerian economy. The results further indicated that the manufacturing output had no causal relationship with RGDP (real economic activities) and financial sector variable. Two sectors, building & construction and hotel & restaurant are reported in the estimation as the critical factors driving manufacturing output.

Following the plethora of studies carried out on the relationship between manufacturing output and economic growth in Nigeria, this study contributes to the body of knowledge by pooling together all the critical and credible fundamental variables identified in the literature as determinants of manufacturing output in Nigeria and also ascertain their relationship with economic growth in Nigeria. This study employs Johansen Cointegration technique, Error Correction Mechanism and Granger causality to analyze the long run and causal relationship between manufacturing output and economic growth in Nigeria.

2. MODEL SPECIFICATION

In order to examine the long run and causal relationships between economic growth and manufacturing output in Nigeria, the study employ multi-factor aggregate production function set up. Two models are specified. The first model gives the manufacturing output fundamentals while the second model expresses growth as a function of observed manufacturing output. The standard form of the production function can be expressed as:

$$Manu_t = A_t f(Techl_t, Dinv_t, Bnkc_t, Lenr_t, Fdi_t, Capu_t, Forex_t, Infl_t) \quad (1)$$

Where $Manu_t$ denotes aggregate manufacturing output at time t, A_t is total factor productivity. $Techl_t, Dinv_t, Bnkc_t, Lenr_t, Fdi_t, Capu_t, Forex_t$ and $Infl_t$ denote technology, domestic investment, bank credit, lending rate, foreign direct investment, capacity utilization rate, foreign exchange rate and inflation rate in the economy in period t respectively. Following Cheung and Yip (2009) estimation approach, it is assumed that technology, domestic investment, bank credit, lending rate, foreign direct investment, capacity utilization rate, foreign exchange rate and inflation rate are critical factors influencing manufacturing output. We therefore modelled manufacturing output function as:

$$Manu_t = A_t Techl_t^{\alpha 1} Dinv_t^{\alpha 2} Bnkc_t^{\alpha 3} Lenr_t^{\alpha 4} Fdi_t^{\alpha 5} Capu_t^{\alpha 6} Forex_t^{\alpha 7} Infl_t^{\alpha 8} \quad (2)$$

By taking the natural logs of both sides[3], an estimable function is obtained as follows:

$$ln\, Manu_t = a + \alpha_1 lnTechl_t + \alpha_2 lnDinv_t + \alpha_3 lnBnkc_t + \alpha_4 Lenr_t + \alpha_5 lnFdi_t + \alpha_6 Capu_t + \alpha_7 Forex_t + \alpha_8 Infl_t + \epsilon_t \quad (3)$$

All variables have earlier been defined and ϵ_t is the white noise error term. The standard form of growth model can be expressed as:

$$Ecogr_t = A_t f(OManu_t) \quad (4)$$

Where $Ecogr_t$ denotes per capita real GDP of the economy at time t, and $OManu_t$ denote observed manufacturing output[4] in period t. It is assumed that manufacturing output influences economic growth. Accordingly, we modelled the following growth production function as:

$$Ecogr_t = A_t OManu_t^{\beta} \quad (5)$$

Taking the natural logs of both sides, an estimable function is obtained as follows:

$$lnEcogr_t = a + \beta lnOManu_t + \epsilon_t \quad (6)$$

3. METHODOLOGY

The methodology explored in this study is purely quantitative. A number of tests were carried out. These include the units root tests, cointegration tests, error correction mechanism(ECM) and Granger Causality tests.

3.1. Unit Root Tests

Time series data are to be used to analyze the variables established in the model. In most cases, time series data are usually non-stationary. There is need for such data to be tested for stationarity before they are used in empirical

[3] .It should be noted that all the variables except technology, lending rate, capacity utilization rate, foreign exchange rate and inflation rate were expressed in natural logs.

[4] Estimated manufacturing output.

estimation. If the variables are stationary in levels without differencing them, they are said to be integrated of order 0. If the variables are stationary after first differencing, they are said to be non stationary in levels and require to be differenced once to become stationary and thus are integrated of order 1.

3.2. Cointegration and Error Correction Mechanism (ECM) Tests

When two or more time-series are not stationary, it is important to test whether there is a linear combination of them that is stationary. This phenomenon is referred to as test for cointegration (Korsu and Braima, 2011). This study also utilize the Johansen Cointegration technique to empirically analyze the long run and short run dynamic interactions among the variables of interest. The Johansen cointegration specification confirmed the long run co-movement among the variables. Following this, the error correction model (ECM) was used to estimate model 7 as a way of ascertaining the short run dynamics of the model. The short run dynamics specification (ECM) is given as:

$$\Delta lnManu_t = \psi_0 + \psi_1 \Delta lnTechl_t + \psi_2 \Delta lnDinv_t + \psi_3 \Delta lnBnkc_t + \psi_4 \Delta Lenr_t + \psi_5 \Delta lnFdi_t + \psi_6 \Delta Capu_t + \psi_7 \Delta Forex_t + \psi_8 \Delta Infl_{t-i} + \beta Ecm_{t-1} + u_t \quad (7)$$

Where β the coefficient of the error correction term. It denotes the speed of adjustment of the model to the long-term equilibrium. $\psi_1 \ldots, \psi_8$ are the short-run elasticity coefficients.

3.3. Granger Causality Tests

Granger (1969) developed a method of testing causal relationship that exists between two or more time series data. Following equation (6), the method is expressed as:

$$Ecogr_t = \alpha_0 \sum_{i=n}^{I} Ecogr_{t-i} + \alpha_1 \sum_{i=n}^{I} Omanu_{t-i} + \varepsilon_{1i} \quad (8)$$

$$Omanu_t = \beta_0 \sum_{i=n}^{I} Omanu_{t-i} + \beta_1 \sum_{i=n}^{I} Ecogr_{t-i} + \varepsilon_{2i} \quad (9)$$

Equations 8 and 9 show the causal relationship that exist between economic growth and observed manufacturing output, when the sum of α as group is statistically significant in Equation 8 and β is not significant in Equation 9, it shows the existence of unidirectional causality from economic growth to observed manufacturing output, and when the coefficient β is significant in equation 8 and is not significant in equation 9, it shows unidirectional causality from observed manufacturing output to economic growth. When all the coefficients in equations 8 and 9 are significant, it shows a bi-directional causality among the variables. This study applies this technique to establish the relationship between economic growth and observed manufacturing output.

3.4. Data Description and Source

This section describes the data employed for the analysis of long run and causal relationships between manufacturing output and its fundamentals on one hand and the relationship between economic growth and manufacturing output on the other hand. The data point chosen for the analysis spanned the period 1980-2017, using Nigeria's annual time series data. The variables considered as determinants of manufacturing output are: technology (proxied by share of research and development in total expenditure), domestic investment (proxied by real value of gross fixed capital formation), banks' credit (proxied by bank loan to manufacturing sector), lending rate (proxied by lending rate to private investors), foreign direct investment (proxied by real gross foreign direct

investment inflows), capacity utilization rate, foreign exchange and price movement (proxied by inflation rate). Similarly, economic growth and manufacturing output are proxied by real gross domestic product (Rgdp) and industrial production. The data utilized for estimation were collected from the Central Bank of Nigeria's Statistical Bulletin and Work Bank Development Indicator (WDI) database.

4. EMPIRICAL RESULTS AND INTERPRETATION

4.1. Stationarity Tests

Prior to econometric estimation, most time series data were often subjected to stationarity tests in order to prevent spurious results. To ascertain the stationarity status of the data, Augmented Dickey-Fuller (ADF) tests was employed. The tests were conducted on the following variables, Manu, Techl, Dinv, Bnkc, Lenr, Fdi, Capu, Forex, Infl, Ecogr and Omanu. The results showed that all the variables are stationary at first difference. Having ascertained the unit root properties of the variables, the next task is to establish whether or not there is a long run cointegrating relationship among the variables by using the Johansen full information maximum likelihood method (Johansen, 1988; Johansen and Juselius, 1990). Table 1 summarizes the unit root tests.

Table-1. Results of ADF Tests

Variable		ADF Test(Trend & Intercept) Test Statistic	Critical Value			Remark
			1%	5%	10%	
Manu	Level	-2.4731	-4.2268	-3.5366	-3.2003	
	1st Diff.	-5.6815	-4.2350	-3.5403	-3.2024	I(1)
Techl	Level	-2.5586	-4.2268	-3.5366	-3.2003	
	1st Diff.	-5.8377	-4.2529	-3.5485	-3.2071	I(1)
Dinv	Level	-5.0826	-4.2350	-3.5403	-3.2024	
	1st Diff.	-5.1988	-4.2436	-3.5443	-3.2047	I(1)
Bnkc	Level	-0.3596	-4.2268	-3.5366	-3.2003	
	1st Diff.	-5.0781	-4.2350	-3.5403	-3.2024	I(1)
Lenr	Level	-2.2123	-4.2350	-3.5403	-3.2024	
	1st Diff.	-6.4965	-4.2436	-3.5443	-3.2047	I(1)
Fdi	Level	-2.4245	-4.2529	-3.5485	-3.2071	
	1st Diff.	-11.6663	-4.2436	-3.5442	-3.2047	I(1)
Capu	Level	-3.5159	-4.2350	-3.5403	-3.2024	
	1st Diff.	-5.5140	-4.2349	-3.5403	-3.2024	I(1)
Forex	Level	-2.2198	-4.2268	-3.5366	-3.2003	
	1st Diff.	-5.6824	-4.2350	-3.5403	-3.2024	I(1)
Infl	Level	-3.4195	-4.2350	-3.5403	-3.2024	
	1st Diff.	-5.7180	-4.2436	-3.5443	-3.2047	I(1)
Ecogr	Level	-1.4883	-4.2436	-3.5443	-3.2047	
	1st Diff.	-44.0763	-4.2350	-3.5403	-3.2024	I(1)
OManu	Level	-2.8262	-4.2529	-3.5485	-3.2071	
	1st Diff.	-9.7064	-4.2436	-3.5443	-3.2047	I(1)

Note: The lag length for the ADF was selected using Akaike Information Criterion (AIC).
Source: Computed using E-View 10.0

4.2. Cointegration Analysis

The existence of cointegration in a series gives an indication of long run co-movement among variables. Cointegration tests results are presented in Table 2. The results reported for the trace and maximum eigenvalue statistics. The trace test statistics indicated nine (9) cointegrating relationships at 0.05 level of significance while the max-eigenvalue statistics showed six (6) relationships at 0.05 level of significance. Both the trace and max-eigenvalue tests showed conflicting conclusions. Johansen and Juselius (1990) recommend the use of the trace statistics when there is a conflict between the two statistics. Consequently, decisions about the number of cointegrating vectors depends on economic theory. The conclusion drawn from this result is that there exists a unique long-run relationship between Manu, Techl, Dinv, Bnkc, Lenr, Fdi, Capu, Forex, Infl, Ecogr and Omanu.

Having established nine cointegrating vectors, an economic interpretation of the long run manufacturing output function by normalizing the estimates of the unconstrained cointegrating vector on manufacturing output[5].

Table-2. Johansen Cointegration Test Results

Hypothesized		**Trace**	**0.05**	
No. of CE(s)	Eigenvalue	Statistic	Critical Value	Prob.**
None *	0.972256	461.1695	197.3709	0.0001
At most 1 *	0.940236	335.7042	159.5297	0.0000
At most 2 *	0.907569	237.0968	125.6154	0.0000
At most 3 *	0.779030	153.7516	95.75366	0.0000
At most 4 *	0.640542	100.9111	69.81889	0.0000
At most 5 *	0.587696	65.10056	47.85613	0.0006
At most 6 *	0.411200	34.09078	29.79707	0.0151
At most 7 *	0.223008	15.55240	15.49471	0.0490
At most 8 *	0.174717	6.721024	3.841466	0.0095
Unrestricted Cointegration Rank Test (Maximum Eigenvalue)				
Hypothesized		**Max-Eigen**	**0.05**	
No. of CE(s)	Eigenvalue	Statistic	Critical Value	Prob.**
None *	0.972256	125.4653	58.43354	0.0000
At most 1 *	0.940236	98.60736	52.36261	0.0000
At most 2 *	0.907569	83.34520	46.23142	0.0000
At most 3 *	0.779030	52.84047	40.07757	0.0011
At most 4 *	0.640542	35.81056	33.87687	0.0290
At most 5 *	0.587696	31.00978	27.58434	0.0174
At most 6	0.411200	18.53838	21.13162	0.1110
At most 7	0.223008	8.831374	14.26460	0.3005
At most 8 *	0.174717	6.721024	3.841466	0.0095

Source: E-View 10.0
* denotes rejection of the hypothesis at the 0.05 level
**MacKinnon *et al.* (1999) p-values

The parameters of the cointegrating vector for the long-run manufacturing output function are presented in Table 3. The normalized cointegrating coefficients displayed in table 3 showed a positive and statistically significant relationship between domestic investment (real value of gross fixed capital formation), capacity utilization rate, foreign exchange rate, inflation rate and manufacturing output. Similarly, the coefficients of technology (share of research and development in total expenditure), bank credit (loan to manufacturing sector), lending rate to private investors and real gross foreign direct investment inflows showed a negative and statistically significant relationship with the manufacturing output. This result however contradicts the findings of Olamade and Oni (2016) and Ogunmuyiwa *et al.* (2017).

An examination of the results showed that four variables drives manufacturing output in the long run. The variables are: domestic investment (real value of gross fixed capital formation), capacity utilization rate, real gross foreign direct investment inflows and price movement (inflation rate).

Table-3. Normalized Cointegrating Coefficients for Manufacturing Output

Variable	**Coefficients**	**Standard Error**
Techl	-0.4259	0.0438
Dinv	0.4530	0.0341
Bnkc	-0.0470	0.0193
Lenr	-0.0273	0.0012
Fdi	-0.0446	0.0152
Capu	0.0033	0.0011
Forex	0.0020	0.0005
Infl	0.0036	0.0004

Source: E-View 10.0

[5] . Mtonga (2006) and Pesaran, Shin and Smith (2000) used this approach in their work.

4.3. Short run Dynamic Specification of Manufacturing Output Model

The cointegration result presented in Table 2 showed a stable long run equilibrium relationship among the series in the model. This have a corresponding error correction representation. The error correction representation captures the short run dynamics of manufacturing output and its determinants. The parsimonious ECM was arrived at by deleting the least statistically significant variables from the overparameterized estimation. The parsimonious error correction model shown in Table 4 indicates that only six variables, current technology, current and lagged one period domestic investment, current and lagged one and two periods lending rate to private investors, current and lagged two periods capacity utilization rate, lagged two period foreign exchange rate and inflation rate at first and second lag are used in explaining manufacturing output in Nigeria. All the estimated variables except current FDI are statistically significant at 0.05 level of significance. Specifically from the result obtained, lagged one and two period coefficients of manufacturing output negatively related to the contemporaneous manufacturing output, while the coefficient of technology positively related to manufacturing output. The current and lagged one period coefficients of domestic investment positively influenced manufacturing output, while current, lagged one and two period lending rate to private investors, current and lagged two period coefficients of real gross foreign direct investment inflows and current period coefficient of capacity utilization rate influenced manufacturing output positively. This results find support with the findings of Ajudua and Ojima (2016). The result also indicated that lagged one period capacity utilization rate, lagged two period foreign exchange rate, lagged one and two period inflation rate negatively related to manufacturing output.

In the short run, four credible determinants of manufacturing output were identified. These include: technology (the share of research and development in total expenditure), domestic investment (real value of gross fixed capital formation), lending rate to private investors and real gross foreign direct investment inflows. An examination of the F-statistic and the adjusted R^2, suggest that the variables in the error correction model significantly explains changes in manufacturing output at $P < 0.05$, accounting for 99 per cent of the short run variation in the series. The coefficient of the ECM term captured the adjustment towards the long run equilibrium. The coefficient of ECM connotes the proportion of the disequilibrium in the differenced dependent variable in one period that is corrected in the next period. The result indicates that the speed of adjustment is low, that is, 0.211303 (21%) of the error is corrected.

Table-4. Parsimonious Error Correction Model

Dependent Variable: ΔMANU
Sample (adjusted): 1983 2017
Included observations: 35 after adjustments

Variable	Coefficient	Std. Error	t-Statistic	Prob.
C	0.011124	0.003143	3.538923	0.0023
ΔMANU(-1)	-0.827271	0.193432	-4.276796	0.0005
ΔMANU(-2)	-1.065108	0.245718	-4.334680	0.0004
ΔTECHL	0.259652	0.033810	7.679833	0.0000
ΔDINV	0.266730	0.059762	4.463204	0.0003
ΔDINV(-1)	0.358472	0.074954	4.782538	0.0001
LENR	0.085312	0.014810	5.760616	0.0000
ΔLENR(-1)	0.145694	0.017352	8.396497	0.0000
ΔLENR(-2)	0.081912	0.014790	5.538498	0.0000
ΔFDI	0.190823	0.040671	4.691866	0.0002
ΔFDI(-2)	0.085747	0.045559	1.882105	0.0761
ΔCAPU	0.101702	0.044189	2.301516	0.0335
ΔCAPU(-1)	-0.183894	0.037496	-4.904307	0.0001
ΔFOREX(-2)	-0.033963	0.004862	-6.985606	0.0000
ΔINFL(-1)	-0.019212	0.004635	-4.145312	0.0006
ΔINFL(-2)	-0.010614	0.004277	-2.481619	0.0232
ECM(-1)	-0.211303	0.134553	-1.570402	0.1337

R^2=0.99
R^(-2)=0.99
D.W=1.79
Prob.(F.Stat)=0.000
Note: D.W = Durbin Watson
Source: E-View 10.0

4.4. Pairwise Granger Causality Tests Results

The results in table 5 indicate that there is a uni-directional causality between economic growth and observed manufacturing output. This is so because the null hypothesis of Economic growth does not cause observed manufacturing output was rejected at the 5% levels of significant. This clearly indicates that observed manufacturing output causes economic growth. However, the reverse causality that economic growth causes observed manufacturing output was found to be insignificant. This means that as critical and fundamental factors determining manufacturing output improves, it would have positive externality on growth quality. This results contradicts the findings of Adofu *et al.* (2015) and Bennett and Anyanwu (2015) which posited that the causal relationship between manufacturing and economic growth was zero. This shows that manufacturing output is an important variable in determining economic growth in Nigeria.

Table-5. Granger Causality Tests

Pairwise Hypothesis	Obs.	F-Statistic	P-Value	Decision	Type of Causality
Oman does not Granger cause Ecogr	35	0.04257**	0.9584	DNR Ho	Unidirectional Causality
Ecogr does not Granger cause Oman	35	4.92489	0.0141	Reject Ho	Unidirectional Causality

** significant at 5% and DNR denote do not reject

5. CONCLUSION AND POLICY RECOMMENDATION

5.1. Conclusion

In this study, the cointegration tests and error correction mechanism model was employed to ascertain the long run and short run dynamics of the determinants of manufacturing output in Nigeria. The study further examined the causal relationship between estimated (observed) manufacturing output and economic growth during the period 1980 to 2017. The empirical estimation conducted in the study reveals quite a number of findings. The unit root tests suggested that all the variables were stationary at first difference. Furthermore, there exist a long run relationship among the variables employed in the model. The long run estimation indicated that, domestic investment, capacity utilization rate, real gross foreign direct investment inflows and inflation rate drives manufacturing output. The short run dynamic specification indicated that, technology, domestic investment, lending rate to private investors and real gross foreign direct investment inflows constitute the credible determinants of manufacturing output. The empirical results from granger causality tests confirmed a uni-directional causality between manufacturing output and economic growth in Nigeria. Manufacturing output can be used as spring board for raising the quality of growth and development. It therefore implies that more resources are required to be channelled to manufacturing activities with the aim of raising productivity potentials and at the same time alleviate poverty.

5.2. Policy Recommendations

The results from this study confirm that the manufacturing output - economic growth relationship is unidirectional. A number of studies have highlighted the pivotal role played by manufacturing activities in the process of growth take-off. This result has a number of policy implications. One, there is need to stimulate the technological base of manufacturing output in Nigeria. Government should upgrade the existing technology for better productivity. The technology should aim at reducing cost of production. Second, the monetary authorities should design policy that would reduce interest rates with the aim of encouraging private investors and prospective entrepreneur to embark on productive investment. Third, there is need for government to commit more funds to the manufacturing sector. Fourth, the government through the Central Bank of Nigeria should moderate foreign exchange in favour of manufacturing sector in order to boost economic growth. Fifth, manufacturing capacity utilization rate is quite low in Nigeria due to series of factors such as epileptic power supply, poor infrastructure base and incoherent government policy implementation. There is need for government step up industrial

production by providing in terms of infrastructure such as good roads, telecommunication and regular electricity. This would remove Nigeria from the circular flow of capacity underutilization.

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