Effect of Manufacturing Capacity Utilization on Economic Growth: An Empirical Evidence of Nigeria

Oniyide F. V., Ogunjinmi O.O.
Economics Department, Lead City University, Ibadan, Nigeria

Abstract: **This study examines the effect of manufacturing capacity utilization on economic growth in Nigeria given the decadence that has been experienced in the manufacturing sector using annual data from 1980 to 2018 sourced from World Development Indicators (WDI) and Central Bank of Nigeria Statistical Bulletin. The study employs Johansen and the Canonical cointegration technique and impulse response function in order to investigate the response of manufacturing capacity utilization to a shock in gross domestic product proxy for economic growth. The Johansen cointegration result reveals a long run relationship among the variables. The empirical result reveals that manufacturing capacity utilization insignificantly decreases gross domestic product in the first model while across the second and third model, manufacturing capacity utilization significantly increases gross domestic product in Nigeria in the long run. Therefore, the study concludes and recommends that government should set up institutional framework that will revamp the moribund manufacturing sector thereby harnessing its full potential in order to contribute to economic growth and development.**

Keywords: **Manufacturing Sector, Capacity Utilization, Economic Growth, Canonical Co-integration Technique.**

JEL Classification: L60, O40.

I. INTRODUCTION

The manufacturing sector is often viewed as the engine of growth and wheel of economic progress of developed and less developed countries as this sector contributes immensely to wealth creation and serve as a panacea to the malady of unemployment. In Nigeria, economic growth was negatively affected by long standing economic recession originating from the collapse of crude oil in the international market in the early 1980s and the accompanying sharp decline in foreign exchange earnings. The excessive reliance on importation of consumer and capital goods, dysfunctional social and economic infrastructure, unprecedented fall in capacity utilization rate in the manufacturing sector and neglect of the agricultural sector, were other important maladies that bedeviled the Nigerian economy which has resulted into low income per head and deepen the misery of poverty amidst the populace [2].

Manufacturing involves producing goods for use or sale by using labour, machinery and bio-chemical processes. The manufacturing process is rooted in industrial production and development which includes an extensive use of technological based tools to achieve availability of goods and services on a large scale and at a low cost hence achieving desirable improvement in the standard of living of the citizens [3]. The Nigerian manufacturing sector has suffered huge set back sequel to the discovery of oil in commercial quantity in the 1960s as this has led to the undue concentration on the oil sector and the inadvertent neglect of other sectors that have contributed to the gross domestic product hitherto.

The adoption of the Structural Adjustment Programme (S.A.P) in 1986 which was purported to revamp the economy and set it on the path of long term growth has not been able to achieve its objective as the economy still lags behind in terms of economic prosperity. Nigeria fell sharply from a middle income country in the 1970s and 1980s to among 30 poorest nations in the world [3]. Although the country is rich in crude oil, yet, it is revealed that vast majority of Nigerians are poor with 84.5% of the population living below the benchmark of $2 per day [4]. The issue of poverty in Nigeria is an offshoot of overdependence on oil sector, maladministration and inability to harness the country's resources especially in the manufacturing sector which could have provided windows of opportunity for employment generation and economic development.

The Nigerian manufacturing sector has experienced significant structural changes over the years despite the besetting challenges which include government intervention, lack of technical know-how, adoption of import substitution strategy and protectionism [5]. The focal point of industrial planners in Nigeria involve the desire to increase the share of manufacturing sector's contribution to GDP, substituting ex ante imported goods with indigenously produced goods, enhancing innovation, competition and job creation. Furthermore, the contribution of the manufacturing sector to GDP is 7.2% in 1970 and decreases to 5.4% in 1980 and increases to 8.1% in 1990 and keeps falling to 6% in 2000 and 4.1% in 2011[6] but rise to 6.83% in 2013. The contribution of the manufacturing sector has been unstable in the last two decades. However, the performance of the manufacturing sector has been be revitalizing as the sector grows by 8.41% in Q1 2013 which is an improvement over 7.70% recorded in Q4 2012 [7].

On the other hand, an author opined that the manufacturing sector is a dynamic sector of the Nigerian economy and this is accompanied by a low capacity utilization rate. In this light, capacity utilization ranges between 78.7% in 1977 to 29.29% in 1995 which represents the highest and lowest rate of capacity utilization [8]. Although it rises to 32.46% in 1996, it falls slightly to 30.4% in 1997 and rise to 32.4% in 1998 and it averages 43% between 2000 and 2004 but it increases to 58.92% in 2009 but decreases slightly to 55.82% in 2010[9]. Given these evidences in the manufacturing sector, has the sector been able to meet the rising demand for finished capital and consumer goods in Nigeria and contribute to net export earnings? This paradox still remains unraveled in the Nigerian context and has beckoned the attention of researchers and policy makers over the years.

Undoubtedly, a large volume of empirical literature exists to date on the nexus between the duos. Most scholars have examined the impact of manufacturing sector on economic growth in Nigeria by including different variables ranging from fiscal policy, to stock market development and exchange rate[3],[10],[11],[12],[13],[14],[15]. However, this current study distinguishes itself by providing an empirical analysis on the impact of manufacturing sector's capacity utilization on economic growth in Nigeria between 1980 and 2018 focusing on periods after the adoption of Structural Adjustment Programme (S.A.P) and various development plans. Specifically, the study will examine the response of manufacturing sector due to ashock in economic growth in Nigeria.

To this end, the rest of the paper is organized as follows: section two provides a brief literature review while the major thrust of section three is the theoretical framework and methodology, section four presents the empirical results and discussion and section five concludes with policy implications.

II. BRIEF LITERATURE REVIEW

I. Stylized Facts of Manufacturing Sector and the Nigerian Economy

The Nigerian economy has experienced various structural reforms since the 1960s especially in the agricultural, industrial and service sector. There have been variations in the contribution of these sectors to income over the past five decades. Significantly, agriculture's share in GDP decline from 60% in the 1960s to 30% of GDP in 2000 to 2004 while the share of industry increased consistently and that of services fluctuates. The Nigerian economy was characterized by major economic crises in the 1980s as result of falling crude oil prices coupled with mismanagement of public funds that left the economy handicapped. Albeit, special policies were undertaken to forestall the crises, it was in 1986 that the Structural Adjustment Programme (SAP) was adopted. Agricultural sector's contribution remained stagnant during the decade, while industry continued to increase, reaching 33%. Notably, in the 1990s agriculture and services continued to fall precipitously while the industrial output outpaced agriculture. However, between 2000 and 2004, there was no significant change in the industrial sector's contribution and there was a slight decrease in the share service [2].

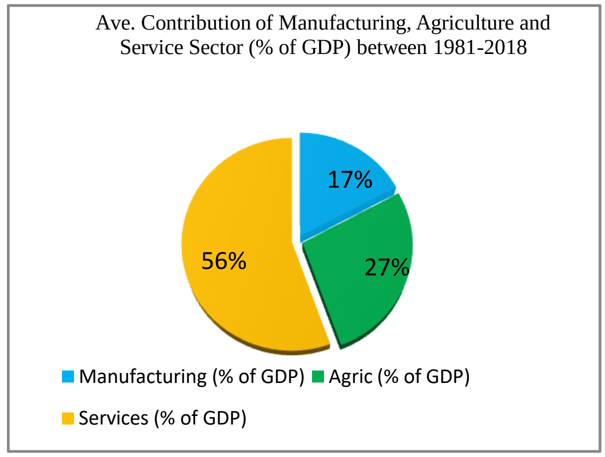

Fig.1. Average Share of Manufacturing, Agriculture and Service Sector (% of GDP)

Source: Authors' Computation

Figure 1 above reveals the sectorial contribution to GDP over the years. It shows that the service sector has the largest share by contributing 56% to GDP between 1981 and 2018 while the agriculture sector performs relatively fair by contributing 27% and the manufacturing sector contributes 17% to GDP over the years which is relatively poor.

Over the years, the manufacturing sector has been an important subsector of the industrial sector. Its contribution of the GDP is also vital as it has been able to generate jobs and income for the citizens. The contribution of the manufacturing sector is 3.8% in 1960 which rise to 5.38% in 1966 and to 6.35% in 1969 but later drop to 3.6% in 1970, 3.33% in 1974 and rise to 8.79% in 1979. In the 1980s, the manufacturing sector peaked at 9.9% and it fluctuated between 5.29% and 8.74% after 1983. In the 1990s, the contribution of the manufacturing sector is characterized by a fall ranging between 5.54% in 1990 and 4.89% in 1999. In 2000-2004, the share of manufacturing lowest ebb of 4.12%.was at its

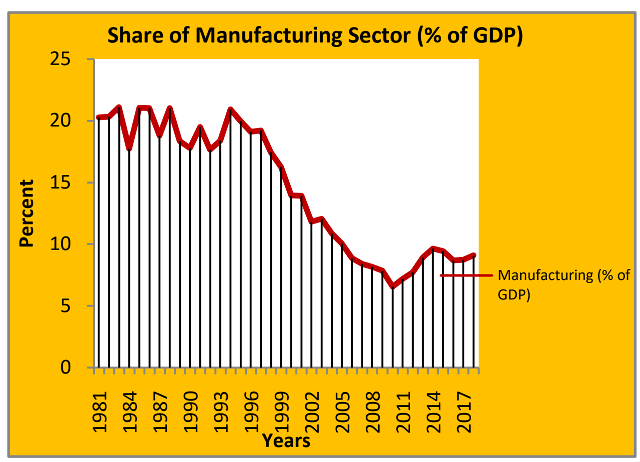

Fig.2. Share of Manufacturing Sector (% of GDP)

Source: Author's Computation from World Bank Development Indicators (2018)

The figure 2 above shows the trend of manufacturing value added from 1981 to 2018. The share of manufacturing sector has been declining since the peak 1995 to 10.06% in 2005; it drops to 6.55% in 2010 and it averages8.67% between 2011 and 2018.

Capacity utilization implies the extent to which an enterprise or a nation actually uses installed productive capacity. Thus, it refers to the relationship between actual output produced and potential output that could be produced with installed equipment if the capacity was fully used. It can also be used to mean the ratio of actual output to potential output [16]. Capacity utilization has been largely analyzed in the economic literature from various perspectives, both theoretically and empirically and has been very often used to explain changes in macro-economic indicators like inflation rate or labor productivity. Many alternative capacity utilization (CU) measures have also been defined, but due to interpretation problems there is no unanimous acceptance as to the most appropriate way of defining and measuring capacity utilization (CU).Similarly, statistics shows that capacity utilization of the manufacturing sector has been dragging and very low compared to other economies of the world.

For instance, average capacity utilization of the Nigeria's manufacturing sector in 1981 is 73.3%, falls to 38.8% in 1986 although it rise to 42% in 1991, it falls to 29.29% in 1995. The value slightly increase to 36.1% in 2000 and by 2009, the manufacturing sector capacity utilization was 55.88% and further rise to 60.5% in 2015.

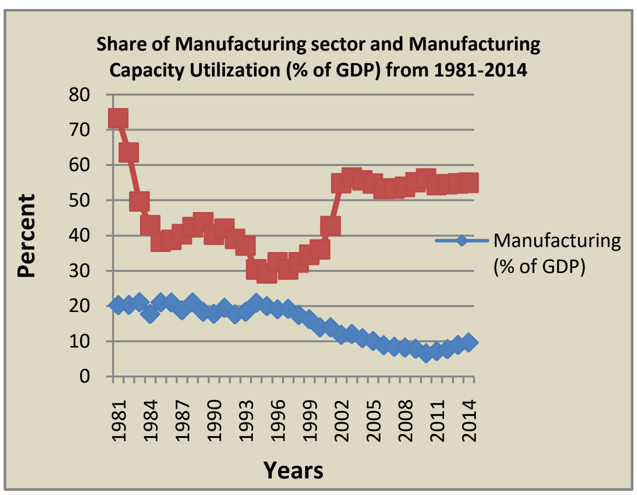

Fig. 3: Share of Manufacturing Sector and Capacity Utilization (% of GDP)

Source: Authors' Computation.

From figure 3 above, it reveals that when capacity utilization was the highest 73.3% in 1981, the share of manufacturing sector was 20.3% which implies that the contribution of manufacturing sector has not been commensurable with the level of capacity utilization. Although, the level of capacity utilization falls in 1986 to 38.8%, the share of manufacturing sector performs relatively fair. Also, as the level of capacity utilization increases in 2002 to 54.9% and remain relatively stable till 2014, the contribution of the manufacturing sector continues to decline over the same period.

II. Measurement of Capacity Utilization

The measure of Capacity Utilization (CU) is important in order to understand the levels of utilization of existing production capacity in the production process. In economic theory parlance, apt evaluation of a production function requires 'capital in use' and not 'capital in place' [17]. 'Capital in use' implies total capital stock available for use in the production process while 'Capital in place' emphasizes the potential capital stock that can be utilized. An estimation of the index of capacity utilization is significant to adjust the existing capital stock in tandem with the capacity utilization level using this relation:

$$Capital\ in\ Use = Capital\ in\ Place \times Capacity\ Utilization$$

The capital in place can be obtained by the using the usual techniques such as perpetual inventory method. However, measuring the rate of capacity utilization requires identifying the capacity output Y^* and then, the capacity utilization rate is defined as the ratio of the actual output Y_0 to capacity output [18]:

$$CU = \frac{Y_0}{Y^*}$$

Hence, capacity utilization is discussed based on the economic measure of capacity utilization for the sake of this study. The rate of capacity utilization assumes that the industry is not in a position to adjust the level of capital in order to achieve equilibrium in the short-run implying that in case of a fall in demand resulting into a decline in output, the level of capital stock cannot be reduced immediately. This will culminate into under-utilization of the existing capacity. Conversely, when increased demand necessitates expansion of capital stock but it being hindered by short-run rigidity, the industry has to cope with overutilization of existing capital stock. Therefore, the challenge of capacity utilization is that of short-run phenomenon.

III. Cost Function Based Approach

Capacity Utilization is essentially a short-run phenomenon conditional on the level of quasi-fixed input available to producers [19][20][21]. Hence, capacity utilization means the optimum level of output for given levels of quasi-fixed factors. The producer's technology can be represented by the production function:

$$Y = f(V, X, t) \quad (1)$$

Where, V is $n \times 1$ vector of variable inputs and X a $j \times 1$ vector of quasi-fixed inputs. Time, t is included as an argument in the production function to proxy for technological advance. Subject to certain regularity conditions [22], if costs are minimized with respect to the variable inputs V conditional on the level of output (Y) the quasi-fixed output(X), then there exists a variable or restricted cost function (C_v) which is dual to:

$$C_v = G(Y, P_v, X, t) \qquad (2)$$

Where, P_v is the vector of prices of variable inputs of order$(1 \times n)$. Thus, the short-run average total cost (SRAC) implies the sum of average variable costs and average fixed costs in equation 3

$$SRAC = \frac{C_v}{Y} + \frac{P_x X}{Y} \qquad (3)$$

Where, P_x is $1 \times j$ price vector for the quasi-fixed inputs. Capacity output, defined as optimal level of output for given level of the quasi-fixed factors, is that level of output which minimized SRAC. Therefore, at point where actual and capacity outputs are equal, that is$Y = Y^*$, equation 3 is minimized. Differentiating equation 3 with respect to Y and setting equal to zero yields equation 4 as follows:

$$\frac{\delta SRAC}{\delta Y^*} = \left(\frac{1}{Y^*}\right)\left(\frac{\delta C_v}{\delta Y^*}\right) - \left(\frac{C_v}{Y^{*2}}\right) - \left(\frac{P_x X}{Y^{*2}}\right) = 0 \qquad (4)$$

For many functional forms for C_v, an exact analytical solution can be obtained for Y^* from equation 1. However, by simple inversion, it is clear that Y^* will depend on the argument of the variable cost function (P_v, X, t) and the price vector of the quasi-fixed factor as shown in equation 5:

$$Y^* = Y^*(P_v, X, P_x, t) \qquad (5)$$

In the setting, capacity output is therefore directly related to variable input prices, the level of fixed factors, the prices of fixed factors and state of technology. From equation 4, the rate of capacity utilization can be defined as actual output, Y, over capacity output, Y^* that is,

$$CU = \frac{Y}{Y^*} \qquad (6)$$

III. EMPIRICAL REVIEW

Several studies have analyzed the relationship between manufacturing sector and economic growth. The searchlight has beamed on these literatures. It was established that a sustained growth in the manufacturing sector enhances a nation's economy in a positive direction as the sector impacts on the nation's GDP [23].It was also examined that manufacturing sector performance and economic growth in Nigeria between 1981 and 2016 using autoregressive distributed lag (ARDL) finds out that manufacturing sector and agriculture sector has a positive non-significant impact on real gross domestic product while services has a significant positive impact on real gross domestic product. While gross capital formation has a negative non-significant impact on real gross domestic product [11].Some scholars investigate manufacturing sector and economic growth in Nigeria from 1990 to 2013 using ordinary least square method. Results show that manufacturing output has a negative non-significant impact on real gross domestic product while average manufacturing capacity utilization rate has a positive significant impact on real gross domestic product. Although exchange rate and interest rate have a negative non-significant impact on real gross domestic product, inflation has a positive non-significant impact and government expenditure has a positive and significant impact [3].

Also, stabilization policies and industrial sector performance in Nigeria was examined between 1970 and 2009 using error correction mechanism. Results show that in the long run, exchange rate has a significant and interest rate has non-significant negative impact on industrial output proxies by manufacturing output while inflation has positive non-significant impact. In the short run, exchange rate and inflation rate have a positive impact; the former is significant while the latter is non-significant. Also interest rate has a significant negative impact on manufacturing output [14].Investigation was carried out on the impact of fiscal policy on the manufacturing sector output in Nigeria between 1990 and 2010 by adopting error correction model. The results show that government tax revenue has significant negative and government expenditure has a positive significant impact on manufacturing sector output [13].It was found out that, although the rate of interest and broad money supply were statistically insignificant, the rates of inflation and exchange together with the external reserve were significant, and negatively related to the manufacturing sector output in both the current, and the previous year. A uni-directional causal relationship exists between real rate of exchange and external reserves and the manufacturing output [24].

More so, examine industrialization and economic growth in Nigeria between 1981 and 2013 using error correction model. The result reveals that manufacturing output has a positive significant impact on economic growth [26].A study was conducted on macroeconomic dynamics and the manufacturing output in Nigeria between 1981 and 2015 using vector error correction model (VECM) reveals that significant positive relationship exists between GDP in the previous year and manufacturing output [27].

Investigation was done on stock market development and performance of the manufacturing sector in Nigeria between 1986 and 2019 using structural vector autoregressive (SVAR) method. The result shows that market capitalization, stock market liquidity and total new issues have positive impact on the manufacturing output both in the short and long-run [10].

More so, the effect of exchange rate fluctuations on the Nigeria manufacturing sector from 1986-2005 was also investigated using ordinary least square method. The result reveals that manufacturing employment rate has a significant positive impact on manufacturing output while manufacturing's foreign private investment and exchange rate have a negative non-significant impact on manufacturing output [15]. In the same vein, study shows that policy reversal and its implication on the economic growth by focusing on the manufacturing sector from 1970-2011 using a vector error correction model (VECM), Result suggests unidirectional causal relationship between exchange rate, interest rate and manufacturing sector output [28]. Also, exchange rate and interest rate have a positive significant impact on economic development while inflation has a positive non-significant impact.

IV. METHODOLOGY

Data

In order to carry out the empirical analysis on the objective(s) of this study, it utilizes a time series data from 1980 to 2018. The data utilized in this study and measurement include gross domestic product growth (Local currency of GDP growth annual %) as a proxy for economic growth, manufacturing capacity utilization (Average capacity utilization % of GDP), manufacturing output (manufacturing sector, % of GDP), inflation rate (Annual % change of consumer price index), gross fixed capital formation (Gross domestic investment % of GDP) and exchange rate (Nominal effective exchange rate divided by index of cost 2010=100). The data were sourced from World Bank development indicators (WDI) and Central Bank Statistical Bulletin.

V. THEORETICAL FRAMEWORK

The basic model to analyse the impact of manufacturing sector's capacity utilization on economic growth is the production function. It shows that capital and labour are positive determinants of output, which is expressed below thus;

$$Y = f(L, K) \quad (1)$$

Where$Y$, is the level of output, K is the capital and L is the labour. This model is adopted in order to examine the relationship between manufacturing sector's capacity utilization and economic growth. In order to capture the impact of capacity utilization on the level of output, the study incorporate manufacturing capacity utilization into the production function expressed thus;

$$Y = f(L, K, V) \quad (2)$$

Where, V represents average manufacturing capacity utilization as an input into the production model. Increase in capacity utilization is expected to improve the level of output. $K$is the capital and L is the labour.

I. Model Specification

Based on the theoretical framework for this study, the study draws a cue from the work of [3] and employs the Johansen and the canonical co-integration method in order to analyze the objective of the study and carry out empirical analysis. The implicit form of the model can be expressed as thus:

$$GDPG_t = f(MANUC_t, MANUO_t, INF_t, GFCF_t, EXCH_t) \quad (3)$$

Where, $GDPG$ represents gross domestic product growth, $MANUC$ represents manufacturing capacity utilization, $MANUO$ represents manufacturing output, INF represents inflation rate, $GFCF$ represents gross fixed capital formation, $EXCH$ represents exchange rate.

Therefore, the econometric model can be specified as thus:

$$GDPG_t = \emptyset_0 + \emptyset_1 MANUC_t + \emptyset_2 MANUO_t + \emptyset_3 INF_t + \emptyset_4 GFCF_t + \emptyset_5 EXCH_t + e_t \quad (4)$$

Where, $\emptyset_0$ represents the constant parameter, $\emptyset_1$ is the coefficient of manufacturing capacity utilization, $\emptyset_2$ represents the coefficient of manufacturing output,$\emptyset_3$ represents the coefficient of inflation rate, $\emptyset_4$ represents the coefficient of gross fixed capital formation, $\emptyset_5$ represents the coefficient of exchange rate, t represents time dimension and e represents the disturbance term.

The apriori expectations of the variables are as follows: manufacturing capacity utilization, manufacturing output and gross fixed capital formation should have a positive relationship with gross.

Table 1: Summary Statistics of the Variables

Variable	Identifier	Measurement	Source	Mean	SD	Min.	Max.
Economic growth	GDPG	Local currency of GDP growth (annual %)	WDI	3.1751	5.5385	-13.1279	15.3292
Manufacturing capacity utilization	MANUC	Average capacity utilization (%)	CBN	47.4131	10.736	29.2936	73.3
Manufacturing output	MANUO	net output of manufacturing sector (as % of GDP)	WDI	14.4293	5.2076	6.5528	21.0983
Inflation rate	INF	Annual (%) change of consumer price index	WDI	19.3504	17.2436	5.388	72.836
Gross fixed capital formation	GFCF	Gross domestic investment (% of GDP)	WDI	36.2204	19.5725	14.1687	89.3861
Exchange rate	EXCH	Nominal effective exchange rate divided by index of cost (2010 = 100)	WDI	149.3952	120.0999	49.7338	536.7732
Note: CBN means Central Bank of Nigeria while WDI means World Development Bank Indicators. Min., Max., and SD represents Minimum, Maximum and Standard Deviation, respectively.							

Source: Author's computation

Domestic product proxy for economic growth, while inflation rate and exchange rate should have a negative relationship. This can be represented symbolically as: $\emptyset_1, \emptyset_2, \emptyset_4 > 0, \emptyset_3, \emptyset_5 < 0$Hence, Table 1 enumerates and describes the variables adopted and summary statistics of the variables.

From table 1 above, gross domestic product growth averages 3.1751; the standard deviation is 5.5385, while the minimum and maximum values are 13.1279 and 15.3292 respectively. In the same vein, the average of manufacturing capacity utilization is 47.4131; the corresponding standard deviation is 10.736 while the minimum and maximum values are 29.2936 and 73.3 respectively. Also, manufacturing output averages 14.4293, the corresponding standard deviation is 5.2076, while the minimum and maximum values are 6.5528 and 21.0983 respectively. More so, the average inflation rate is 19.3504, the standard deviation is 17.2436, the corresponding minimum and maximum values are 5.388 and 72.836 respectively. Likewise, the average gross fixed capital formation is 36.2204, the standard deviation is 19.5725 and the corresponding minimum and maximum values are 14.1687 and 89.3861 respectively. Furthermore, the average exchange rate is 149.3952, the corresponding standard deviation is 120.0999, the minimum and maximum values are 49.7338 and 536.7732 respectively.

VI. EMPIRICAL RESULTS AND INTERPRETATIONS

This study builds on the axiom that manufacturing output contributes significantly economic growth proxies by gross domestic product in Nigeria. Hence, efficient manufacturing capacity utilization will improve the contribution of manufacturing sector to economic growth in Nigeria. In order to achieve the objectives of this study, the Johansen and Canonical co-integration technique was adopted in order to examine the long run contribution of manufacturing capacity utilization to gross domestic product. Therefore, the impact of shocks on gross domestic product using impulse-response analysis is utilized [10].

I. Unit root tests

Before checking if series exhibit long-run relationship, the standard procedure is to examine and ascertain that the variables do not have a unit root in order to avoid a spurious regression or white noise. Therefore, this paper utilizes both the Augmented Dicky Fuller (ADF) and Phillips-Perron unit root tests. The null hypothesis for both tests is that the series is non-stationary and the null hypothesis is rejected if the p-value is statistically significant. Hence, the tests were estimated with both constant and trend terms of the series. Table 2 result shows that we accept the null hypothesis of unit root in the series at their level form. However, we reject the null hypothesis of unit root after integrating the series, implying stationarity at their first difference form with statistical significance between 1% and 10%.

Table 2: Unit root Test

Variables	ADF		PP		Decision
	level	First difference	level	First difference	
GDPG	-3.374	-3.87*	-3.865*	-11.687**	I(1)
MANUC	-3.517	-3.636*	-3.920*	-3.517	I(1)
MANUO	-2.736	-7.911**	-2.101	-7.736**	I(1)
INF	-4.387**	-2.831	-2.824	-10.326**	I(1)
GFCF	-3.309	-4.659	-3.514	-5.206**	I(1)
EXCH	-1.989	-4.151*	-1.985	-4.94**	I(1)

Note: * and ** denote significance at 10%, and 1 % respectively. The null hypotheses (H_0) for ADF and PP Unit root. The optimal lag orders for Dickey and Fuller (1979) ADF test is determined by AIC, while the bandwidth for Phillips and Perron (1988) PP test is determined by using the Newey-West Bartlett kernel. We include both constant and trend in the estimation.

Source: Author's computation.

II. Co-Integration Analysis

Having ascertained the stationarity of the series at first difference, the study therefore proceeds to examine if long-run relationship exists among the variables. Hence, the study employs the Johansen test for co-integration with one lag structure. The results are presented in table 3 below. The null hypothesis of no co-integration is rejected from the Mackinnon-Haug-Michelis p-value.

Table 3: Johansen Co-integration Results

Co-integrating Rank	Trace Test			Maximum Eigenvalue		
	Statistics	Critical Value	P-value	Statistics	Critical Value	P-value
None *	127.062	95.75366	0.0001	60.28838	40.07757	0.0001
At most 1	66.77358	69.81889	0.0854	34.37629	33.87687	0.0436
At most 2	32.3973	47.85613	0.5902	13.8951	27.58434	0.8298
At most 3	18.5022	29.79707	0.5291	10.86723	21.13162	0.6606
At most 4	7.634963	15.49471	0.5052	7.005247	14.2646	0.4885
At most 5	0.629715	3.841466	0.4275	0.629715	3.841466	0.4275

Note: The hypothesis (H_0) of no co-integration is rejected.

Source: Author's computation

Based on the result of the co-integrating relationship from Johansen test, the study proceeds to ascertain long-run relationships with the results from the canonical co-integration estimation technique by utilizing three model specifications. That is, no trend in the first column, linear trend in the second column and quadratic trend in the third column. Results revealed in table 4 below shows that manufacturing capacity utilization decreases gross domestic product in the first model while across the second and third model, manufacturing capacity utilization increases gross domestic product proxy for economic growth in Nigeria. Implying that a unit increase in manufacturing capacity utilization will lead to a 9.95% fall in gross domestic product in the first model although not statistically significant, 12.86% and 14.77% significant increase in gross domestic product in the second and third model respectively in the long run. This result is aligns with the a priori expectation and it is consistent with the findings of [3]. It has been observed that an efficient and optimal utilization of average manufacturing capacity will improve the level of productivity in the economy in the long run.

On the other hand, manufacturing output consistently shows a positive non-significant relationship with gross domestic product in the long run. This implies that a unit increase in manufacturing output will result in a 46.41%, 12.8%, and 9.3% non-significant increase in gross domestic product in the long run in Nigeria. The manufacturing output is viewed as an engine of economic progress but its contribution is not significant in Nigeria due to the decline and decay experienced in the manufacturing sector, inability of the output to compete in the international market, reliance on outdated technology in production processes, high cost of production, inadequate infrastructural facilities coupled with administrative bottlenecks. This result aligns with the a-priori expectation. The result is contrary to the findings of [3].

On the other hand, inflation was found to be negatively related to gross domestic product consistently across the three models. This implies that a unit increase in inflation rate will result in 16.05%, 10.41% and 7.53% significant fall in gross domestic product in Nigeria in the long run. The result follows the a priori expectation because; a high rate of inflation will erode the productivity level as supply of goods and services cannot match up with aggregate demand. This result is contrary to the result of [3].

Table 4: Canonical Co-integration Results

Variables	[1]	[2]	[3]
MANUC	-0.0995 (0.1485)	0.1286* (0.05028)	0.1477* (0.0685)
MANUO	0.4641 (0.6052)	0.1280 (0.2061)	0.093 (0.2592)
INF	-0.1605* (0.0607)	-0.1041** (0.0206)	-0.0753** (0.0247)
GFCF	-0.2174 (0.1195)	-0.5371** (0.0547)	-0.4242** (0.0662)
EXCH	-0.0279* (0.0072)	-0.0209** (0.0024)	-0.0124** (0.0034)
Linear Trend		-0.8126** (0.0746)	-0.4216 (0.2118)
Quadratic Trend			-0.0057 (0.0039)
Observation	38	38	38
R-Squared	0.0667	0.6688	0.6906

***Note**: * and ** denote significance at 10%, and 1 % respectively. Models [1], [2] and [3] represents constant trend, and quadratic trend, respectively. Long run covariance estimates (Prewhitening with lags = 2 from AIC maxlags = 2, Bartlett kernel, Newey-West fixed bandwidth = 4.0000). Variables are in their normal form.*

Source: Author's computation

Also, gross fixed capital formation shows a negative relationship with gross domestic product consistently across the three models although insignificant in the first model but statistically significant in second and third model. By implication, this means that a unit increase in gross fixed capital formation will lead to a 21.74% (non-significant), 53.71% and 42.42% significant decrease in gross domestic product. This can be attributed financial loopholes in the budgetary allocation, mismatch between government policy and investment decisions which creates a gap rather than linking investment with improved output in the long run. This result contradicts the a-priori expectation and is consistent with the findings of [11].

More so, exchange rate shows a significant negative relationship with gross domestic product consistently across the three models. This implies that a unit increase in exchange rate will induce a 2.79%, 2.09% and 1.24% decline in gross domestic product which means that a significant appreciation in the value of naira against other foreign currencies (fall in exchange rate) which contribute to gross domestic product as major of our local industries rely heavily on imported raw materials which can be purchased at a relatively cheaper rate hence, reducing the cost of production in the long run. This is consistent with the a-priori expectation. This result contradicts the findings of [28] but corroborates the result of [3].

III. Diagnostics

In order to accord some level of confidence to the finding, diagnostics tests were carried on the model. The results presented in table 5 enumerates that the model was subjected to autocorrelation, normality and heteroscedasticity tests.

Table 5: Diagnostics results

Test	Statistics	P-Value
Autocorrelation LM test	0.1379	0.0857
Jarque Bera Test	0.8582	0.6511
Heteroscedasticity Test (with cross term)	0.1905	0.2812
Heteroscedasticity Test (without cross term)	0.0943	0.1035

Source: Author's computation

Therefore, after conducting the diagnostics tests, the study proceed to analyze the effects of shocks and the results are presented hereafter in table 6.

IV. Impulse Response Function results

The impulse response function is conducted in order to account for the response of gross domestic product to shocks from other dependent variables in the model. More generally, the impulse response function (IRF) explains the reaction of the dependent variable to one of the innovations in the vector auto-regression (VAR) model. Intuitively, it explains the progression of the interested variable along a time dimension after a shock in a given moment [29]. The study utilized the IRF because of its relative importance in economic and policy effectiveness analysis. Hence, table 6 shows the response of gross domestic product to a standard deviation change in the regressors.

Table 6: Variance Decomposition (response of Economic growth (GDPG))

Period	GDPG	MANUC	MANUO	INF	GFCF	EXCH
1	100	0	0	0	0	0
2	88.075	0.761	6.3152	0.1043	3.5467	1.1978
3	87.2233	3.1391	4.6256	0.8404	2.9297	1.2419
4	86.1133	2.6238	4.9445	0.7569	3.1131	2.4484
5	84.7124	3.9049	5.5953	0.7281	2.7746	2.2847
6	84.0898	4.1479	5.6627	0.6778	2.3740	3.0473
7	82.5887	4.5650	6.3395	0.6509	2.1915	3.6643
8	81.5687	5.4315	6.4477	0.6251	1.8826	4.0444
9	80.6625	5.8392	6.6983	0.6047	1.6939	4.5014
10	80.1026	6.2673	6.7769	0.6081	1.5198	4.7252

Response of economic growth to one standard deviation shock from endogenous regressors using Cholesky ordering

Source: Author's computation

The response of gross domestic product to a one standard shock to manufacturing capacity utilization shows positive consistency over a 10-year period and this outcome is corroborated by the results from the canonical co-integration result. Also, the response to shocks from manufacturing output, inflation rate, gross fixed capital formation and exchange rate are consistently positive over the time frame of 10 years (See the diagrammatic expression of the impulse response function in the appendix).

This study examines the effect of manufacturing capacity utilization on economic growth in Nigeria. This is based on the decline in the contribution of the manufacturing sector to gross domestic product over the years. Hence, this study seeks to investigate the long run relationship between the manufacturing capacity utilization and economic growth and the response of manufacturing capacity utilization to shocks in gross domestic product proxy for economic growth. The study used an annual data on Nigeria from 1980 to 2018 utilizing various econometric techniques especially the canonical co-integration technique in order to establish the long run impact of manufacturing capacity utilization on economic growth. The key explanatory variable, which is manufacturing capacity utilization decreases gross domestic product in the first model while across the second and third model, manufacturing capacity utilization increases gross domestic product proxy for economic growth in Nigeria. Implying that a unit increase in manufacturing capacity utilization will lead to a 9.95% fall in gross domestic product in the first model, although not statistically significant. 12.86% and 14.77% significant increase in gross domestic product in the second and third model respectively in the long run. Also, the analysis shows that as the time frame expands, manufacturing capacity utilization, manufacturing output, inflation, gross fixed capital formation and exchange rate tend to drive gross domestic product in Nigeria.

Also, empirical findings reveal that manufacturing output consistently shows a positive non-significant relationship with gross domestic product in the long run. This implies that a unit increase in manufacturing output will result in a 46.41%, 12.8%, and 9.3% non-significant increase in gross domestic product in the long run in Nigeria. More so, inflation was found to be negatively related to gross domestic product consistently across the three models. This implies that a unit increase in inflation rate will result in 16.05%, 10.41% and 7.53% significant fall in gross domestic product in Nigeria in the long run. Furthermore, gross fixed capital formation shows a negative relationship with gross domestic product; this means that a unit increases in gross fixed capital formation will lead to a 21.74%, 53.71% and 42.42% significant decrease in gross domestic product. Likewise, exchange rate shows a significant negative relationship with gross domestic product consistently across the three models. This implies that a unit increase in exchange rate will induce a 2.79%, 2.09% and 1.24% decline in gross domestic product.

Therefore, based on these empirical findings the study recommends the following: firstly, government should set up institutional framework that will revamp the moribund manufacturing sector thereby harnessing its full potential by contributing to economic growth and development. Secondly, government should endeavor to increase investment in the provision social overhead capital in order to improve direct productive activities that can compete effectively and contribute to foreign exchange earnings. Lastly, government should set up strict monitoring institutions and should ensure harmonization of policies and macroeconomic goals in order to avoid leakages in investment expenditure.

REFERENCES

[1] World Bank (2005), World Bank Development Indicators. *Washington D.C.*

[2] Aregbeyen, J. B. O. (2016). Nigeria's Manufacturing Sector: Performance and Challenges. In Nigeria's Industrial Development, Corporate Governance and Public Policy, edited by N. I. Nwokoma, W. A. Ishola, 71-80. Lagos: University of Lagos Press.

[3] Adofu, I., Taiga, U. U and Tijani, Y. (2015). Manufacturing Sector and Economic Growth in Nigeria. *Donnish Journal of Economics and International Finance*, 1(1): 1-6.

[4] World Development Index (2012). "The World Bank." 2012. https://www.worldbank.org/.

[5] Adeoye, B. and Akinsola, F. (2016). Green Growth Strategy in the Manufacturing Sector: Lessons for Emerging Economies. In Nigeria's Industrial Development, Corporate Governance and

Public Policy, edited by N. I. Nwokoma, W. A. Ishola, 287-305. Lagos: University of Lagos Press

[6] Central Bank of Nigeria, (2012). CBN, Statistical Bulletin, Abuja.

[7] National Bureau of Statistics (2013). Annual statistical Bulletin. Abuja: NBS.

[8] Ayorinde, F. and Ola, O. (2001). The Technological Response of the Manufacturing Sector to Trade Liberalization in Nigeria, *Nigerian Journal of Economic and Social Studies*, 43(1): 145.

[9] Central Bank of Nigeria, (2011). CBN, Statistical Bulletin, Abuja

[10] Alematu, A., David, T. A., Ochugudu, A. I. and Audu, T. (2020). Stock Market Development and the Performance of the Manufacturing Sector in Nigeria. International Journal of Advannced Research in Management and Social Sciences, 9(2): 46-66.

[11] Afolabi, A. and Laseinde, O. T. (2019). Manufacturing Sector Performance and Economic Growth in Nigeria.*International Conference on Engineering for Sustainable World*, 1-7.

[12] Abdullahi, M., Ladan, A. S. and Musa, A. S. (2019). Nexus between Commercial Banks' Loan to Manufacturing Sector and Economic Growth In Nigeria. International Journal of Management Studies, Business and Entrepreneurship Research, 4(3): 16-27.

[13] Eze, O. R. (2014). Impact of Fiscal Policy on the Manufacturing Sector Output in Nigeria: An Error Correction Analysis. *British Journal of Business and Management Research*, 1(2): 31-54.

[14] Tunde, A. B. (2016). Stabilization Policies and Industrial Sector Performance in Nigeria.In Nigeria's Industrial Development, Corporate Governance and Public Policy, edited by N. I. Nwokoma, W. A. Ishola, 385-411. Lagos: University of Lagos Press.

[15] Opaluwa, D., Umeh, J. C. and Abu, A. A. (2020). The Effect of Exchange Rate Fluctuations on the Nigerian Manufacturing Sector.*African Journal of Business Management*, 4(14): 2994-2998.

[16] Nelson, R. A. (1989). On the Measurement of Capacity Utilization.*The Journal of Industrial Economics,* 37(3): 273-286.

[17] Solow, R. M. (1957). Technical Change and the Aggregate Production Function.*Review of Economics and Statistics*, 39: 312-320.

[18] Kirkley, J., Morrison, C. J. and Squires, D. (2002). Capacity and Capacity Utilization in Common-pool Resource Industries.*Environmental and Resource Economics*, 22: 71-97.

[19] Klein, L. R. (1960). Some Theoretical Issues in the Measurement of Capacity.*Econometrics*, 28(2): 272-286.

[20] Morrison, C. J. (1985). Primal and Dual Capacity Utilization: An Application to Productivity Measurement in the U.S. Automobile Industry. *Journal of Business and Economic Statistics*, 3(4): 312-324.

[21] Berndt, E. R. and Morrison, C. J. (1981). Capacity Utilization Measures Underlying Economic Theory and an Alternative Approach.*American Economic Review*, 71(2): 48-69. Central Bank of Nigeria, (2011). CBN, Statistical Bulletin, Abuja.

[22] Diewert, W. (1974). Functional Forms for Revenue and Factor Requirements Function. International Economic Review, 15(1): 119-130.

[23] Penélope, P-L. &Thirlwall, A.P. (2013). A New Interpretation of Kaldor's First Growth Law for Open Developing Economies. University of Kent KDPE School of Economics Discussion Papers, 1312. Retrieved from: https://www.kent.ac.uk/economics/documents /research/papers/2013/1312.pdf.

[24] Imoughele, L. E. (2014). Empirical Investigation of the Impact of Monetary Policy on Manufacturing Sector Performance in Nigeria.*International Journal of Education and Research*, 2(1): 1 – 20

[25] Kida, M. I. and Angahar, J. S. (2020). Industrialization and Economic Growth in Nigeria.https://www.researchgate.net/publication.

[26] Onakoya, A. B. (2018). Macroeconomic Dynamics and the Manufacturing Output in Nigeria.*Mediterranean Journal of Social Sciences*, 9(2): 43-54.

[27] Kida, M. I. and Angahar, J. S. (2020). Industrialization and Economic Growth in Nigeria.https://www.researchgate.net/publication.

[28] Amos, N. B., Ajike, E. O. and Akinlabi, B. H. (2014). Policy Reversal and its Implication on the Economic Growth of Nigeria: A Study of the Nigeria Manufacturing Sector. International Journal of Economic and Business Review, 2(9): 11-19.

[29] Lütkepohl, H., 2005. New Introduction to Multiple Time Series Analysis.Springer Science & Business Media.

APPENDIX

Figure 4. Impulse Response Function