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Effect of Capacity Utilisation on Manufacturing Firms' Production in Nigeria

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Strictly as per the compliance and regulations of:

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I. Introduction

Capacity utilisation rate plays a crucial role in evaluating economic performance of manufacturing firms. Capacity utilisation is an important factor to be considered when an increase in productivity and expansion of firm's production become necessary. Also, the need to consider capacity utilisation is vital in many developing countries especially in Nigeria where capital is very scarce and mostly under utilised (Adeyemi & Olufemi, 2016). Theory of economies of scale stipulates that a cost-minimizing firm has a tendency to increase the utilisation of its capital if the returns to scale decreases as its production increases (Afroz and Roy, 1976). That is, the rate of capacity utilisation could be determined endogenously.

Moreover, the level of capacity utilisation does not only determine how much more output obtained by greater utilisation of existing capital but also defines expansion of capacity of a firm for a targeted level of output (Afroz and Roy, 1976).In view of this, the rate of capacity utilisation is directly related to the level of employment but inversely related to per unit capital service cost. Thus, an increase in capacity utilisation means a reduction in the average cost of production Afroz and Roy, 1976).

As crucial economic indicator as it is, capacity utilisation has not received due attention from development economists especially in most developing countries, Nigeria inclusive. Though not greatly dealt with, capacity utilisation does not only explain the relationship between actual output and maximum or potential output, but also imply the level of market demand. Over- orunder-utilisation of plant capacity can reduce plant competitiveness by increasing operating costs (Seguin and Sweet land, 2014). When market demand grows, capacity utilisation will rise. By contrast, if demand weakens, capacity utilisation will slacken. In the short run, capacity utilisation is important to determine the elasticity of supply. For a firm that is close to 100% of capacity utilisation rate, then supply will be very inelastic since there will be no room for capacity expansion to meet the required increase in supply. That is, regardless of changes in the price, supply remains relatively the same in the short run. Though, firms can increase productive capacity and increase the amount of capital in the long runto cope with excess supply.

In theory, capacity utilisation is measured in 100% efficiency level, however, in practical sense, capacity utilisation may not exceed 90% maximum level especially in developing economies due to some setbacks in the production process such as lack of proper labour monitoring and supervision, wastages in the process and machine breakdown (Afroz and Roy, 1976).In other words, each firm will choose its level of utilisation based on the principle of cost minimization and then explores how such will determine its normal rate of utilisation (Nikiforos, 2012).

Thus, the rate of capacity utilisation remains an important concept, though often neglected, in the production process because the presence of idle resources that can be readily engaged in production activities constitute a big problem in explaining fluctuations in firm output in Nigeria where under utilisation of some productive equipment have become rampant in almost all productive firms. Though, under utilisation of resources in productive firms is not only peculiar to Nigerian firms. For instance, Bresnahan and Ramey (1993) in a microeconomic evidence found that the most usual way of adjusting production is to shut the

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plant down for a week in the American automobile industry. Similar, surveys of business activities showed in most Western European countries that an important proportion of firms run excess capacities from time to time (Fagnart, Licandro and Portier, 1999).

In Nigeria, most manufacturing firms have been faced with capacity under utilisation and this had constituted a threat to firm productivity and production growth, and served as an impediment to economic growth and development of the country. The emphasis of the present government to promote local production has motivated further research in the area of capacity utilisation and firm production in Nigeria which is often neglected in manufacturing firms.

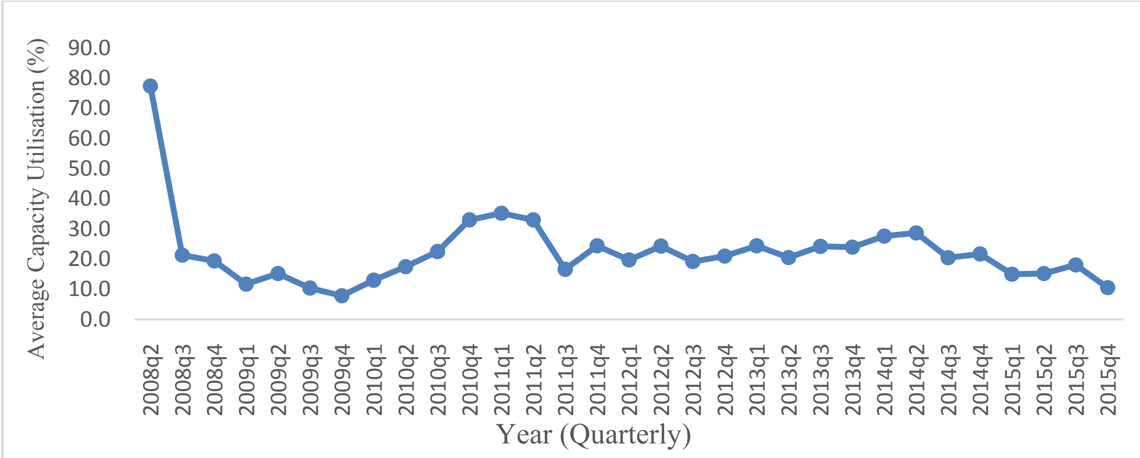
In literature, the sources of productivity change is divided into four, namely: pure technical efficiency change, technical change, scale efficiency change (Coelli *et al*. 2005; Kumar & Basu 2008; Melfou*et al*. 2009) and capacity utilisation change. Capacity utilisation change is another important factor that affects productivity growth (Basu & Fernald, 2001; Gu & Wang, 2013), however, few studies have examined the contribution of capacity utilisation change in the production process of Nigerian manufacturing firms. Despite the important contribution of manufacturing firms to Nigerian economy, there is limited literature focusing on the capacity utilisation and production in this sector. Few studies that have delved into this area focus on the determinants of capacity utilisation in the Nigerian manufacturing sector (*see* Adeyemi & Olufemi, 2016). In developed countries for instance, Gu & Wang (2013) examined Canadian manufacturing industries and found that manufacturing industries' productivity slowdown was largely associated with a decline in capacity utilisation. Thus, measuring the level of capacity utilisation and most importantly examining the effect of capacity utilisation on manufacturing firms' production is therefore an important step towards improving the manufacturing firms' production in Nigeria.

The rest of the study is organized in the following ways. Section 2explains concept of capacity utilisation; section 3 presents review of relevant literature; section 4presents empirical methodology and data sources; whilesection5has to do with interpretation of empirical results of the study. Finally, conclusion and policy recommendations were presented in section 6.

II. Concept of Capacity Utilisation

Capacity of a plantis seen as the maximum output that can be produced using the given technology and the fixed input when the variable input vector may take any non-negative value. Hence capacity utilisation is equal to the ratio of observed output to the capacity of the plant (Coelli, Grifell-Tatje & Perelman, 2002). Thus, capacity utilisation refers to the ratio of actual output to the maximum or potential capacity output from a quasi-fixed inputs. Technically, Johansen (1968) defined capacity output as the maximum output that can be produced from a specific bundle of the quasi-fixed inputs even where there is no restriction on the availability of variable inputs.

In this present study, capacity refers to the maximum outflow which could be achieved from the installed capital stock in a given period. In other words, capacity is the amount of output a firm can produce which depends upon the amount of labour, buildings, machinery and other forms of capital stocks it has available for production process. Utilisation on the other hand means actual amount of capacity which is being employed to get output in the same period (Afroz and Roy, 1976). Hence, capacity utilisation in economic term implies the ratio of actual output to the level of optimum output beyond which the average cost of production begins to rise. That is, capacity utilisation expresses output as a percentage of total potential output. In other words, capacity output can be defined either in economic term (Cassel 1937, Klein, 1960, Berndt & Morrison, 1981) or in technical term (Johansen, 1968). Thus, the economic definition was adopted in this study. However, pure technical efficiency relative to full capacity measures the difference between actual outputs to capacity output. It is caused by both inefficient utilisation of the variable inputs and fixed inputs. Deb (2014) denotes it as gross capacity utilisation and divides capacity utilisation into net capacity utilisation and gross capacity utilisation. Net capacity utilisation measures the difference between frontier output and capacity output. It is caused by only inefficient utilisation of the fixed inputs.



(Source: CBN Statistical Bulletin, 2015)

Fig. 1: Average (Total) Capacity Utilisation in Nigeria

Generally, Fig. 1 shows that average (total) capacity utilisation (ACU) decreased from 77.4% in the second quarter of 2008 to about 21.3% in the third quarter of the same year. This quarter connotes the period when economic and financial crisis began to manifest in Nigeria and other developing countries. The crisis affected virtually every sector of the economy. However, the effect of this crisis was largely significant and more pronounced in financial and manufacturing sectors. Average capacity utilization decreased 21.3% in second quarter of 2008 to 7.8% in the fourth quarter of 2009 when the crisis was at its prime in the country. After this time, Nigeria and most other developing countries had started devising mechanisms to come out of the quagmire coupled with other international measures put in place such as bail outs and so on. This was reflected in the increase in the average total capacity utilisation in Nigeria that started to increase in the first quarter of 2010 which was around 13.0% and increased to 35.2% in the first quarter of 2011.From the second quarter of 2011, the trend shows that average total capacity utilisation in Nigeria assumed an oscillatory movements and it was decreasing unstable, 33.0% in second quarter of 2011, 24.3% in first quarter of 2013, 27.6% in first quarter of 2014, 15.0% in first quarter of 2015 and finally 10.5% in the fourth quarter of 2015. However, the average total capacity utilisation was volatile during these years and volatile capacity utilisation may present a challenge for stable economic development. The capacity utilisation in Nigerian manufacturing firms follows a similar volatile pattern as total rate.

III. Literature Review

In Nigeria, Adeyemi and Olufemi (2016) investigated the determinants of capacity utilisation in the Nigerian manufacturing sector between 1975 and 2008, by administering structured questionnaire to assess the operational materials and the performance of the selected firms. The study employed co integration and Error Correction Model(ECM) as the estimation techniques and found a positive relationship between consumer price index, fixed capital formation in manufacturing sector and capacity utilisation. However, negative relationship between electricity generation, real manufacturing output growth rate and capacity utilisation were found.

Deb (2014) confirmed that utilisation of a plant capacity is a possible channel through which economic reforms enhanced the productivity growth in total manufacturing sector in India. The study estimated capacity utilisation rate in Indian manufacturing sector. The result showed that the annual average capacity utilisation rate in Indian manufacturing was lower over the pre-reform periods, and in the post-reforms era, the capacity utilisation rate grew faster. Moreover, the result of regression analysis confirmed that economic reforms exerted positive impact on productivity growth in total manufacturing sector more than the positive impact of improved capacity utilisation. Nikiforos (2012) examined the endogeneity of the rate of capacity utilization in the long run at the firm level by considering the factors that determine the capacity utilisation of resources of the cost minimizing firm. The study concluded that the cost minimising firm has an incentive to increase the utilization of its capital if the rate of the returns to scale decreases as its production increases.

Also, Coelli, Grifell-Tatje and Perelman (2002) measured the contribution of capacity utilisation to profitability along with measures of technical inefficiency and allocative inefficiency. Using data from 28 international airline companies for empirical illustration and the result showed that airline companies achieve profit levels which were on average US$815m below potential levels, and that 70% of the gap may be attributed to unused capacity. Jessica (2004) investigated the effects of foreign competition on the level of capacity utilisation of a firm using firm-level data of twelve countries. The results showed that capacity utilisation was higher for exporter firms, and an increased level of exports also affected capacity but at a decreasing rate. The study also indicated that if exports increased more than 49 or 51 percent of total sales, capacity utilisation starts decreasing. Moreover, more flexibility to make factor choices affected capacity utilisation positively. Thus, the study concluded that policy makers can move beyond reducing barriers to trade by trying to build around other incentives that increase capacity utilisation.

In a study of productivity performance and capacity utilisation in the Indian food processing industry over 1988 and 2005, Kumar & Basu (2008) found that the Indian food processing industry performed far below its potential and concluded that lack of development of technological progress was responsible. With respect to productivity, the productivity performance of 453 United State manufacturing industries from 1976 to 1999 based on firm level data was investigated by Abraham & White (2006) and found remarkable heterogeneity and disparity exists within industries and between industries. Similarly, Syverson (2004) explored productivity performance in 443 U.S. manufacturing industries and found evidence of large variations within and among industry plants.

IV. Methodology

a) Measure of Capacity Utilisation Rate

Capacity utilisation can be measured using technical or economic approach. The later describes capacity utilisation as the ratio of observed output to the capacity of the plant. In line with Sahoo & Tone (2009), the optimal rate of capacity utilisation of variable inputs can be obtained as given below:

$$\phi_{io} = \sum_{j \in I_N} x_{ij} \lambda_j^* / x_{io} (\forall_i \in I_V) \qquad (1)$$

Where ϕ_{io} is the capacity utilisation rate for optimal output, x_{ij} / x_{io} is the input set given its optimal level and λ_j^* is the optimal scaleI_N and I_V are individual firm inputs and individual firm's variable inputs respectively. Capacity utilisation could therefore be given as in equation 2. In this measure, capacity utilisation will take a value between zero and one. A value of one indicates that the plant is operating at full capacity.

$$\phi = \frac{Y}{Y^C} \qquad (0 \le \phi \le 1) \qquad (2)$$

Where ϕ is the capacity utilisation rate, Y is the actual annual output and $Y^C$is the observed or potential output. In literature, majority of previous studies used survey methods or *ad hoc*proxies to measure capacity utilisation, for instance Solow (1957) and Basu (1996)used unemployment rates and growth rate of materials respectively, while Basu and Fernald(2001)employed hours worked per worker to measure capacity utilisation. In this present study, capacity utilisation is viewed and measured from economic perspective.

b) Model Specification

The economics of firm behaviour is first examined by showing the production function, which is the relationship between the firm's output and its inputs, which are all the factors of production necessary to produce the product. Obviously, for a firm to be profitable, the cost of its inputs must be less than the revenue received for the output. Moreover, economic capacity output of the firm is the level of production where the firm's long-run average cost curve reaches a minimum point and because long-run average cost is considered, no input is held fixed (Deb, 2014).

Production functions describe a technical relationship between all physical inputs (be it capital, labour, energy and material) used in a production process and the maximum amount of outputs that can be obtained from the production process (Fagnart, Licandro and Portier, 1999). Individually, a firm could design its future productive equipment by choosing simultaneously a quantity of capital goods and a blueprint employment level according to a given Cobb–Douglas production function:

$$Y_t = A_t K_t^{\alpha} L_t^{1-\alpha} \qquad (3)$$

Where Y_t represents the manufacturing output at time t, L is the amount of labour hours used, K includes both physical and human capital employed, but there are no diminishing returns to capital, and A, the efficiency factor or total factor productivity (TFP) is intended to represent any factor that affects technology. α and 1- α are the elasticities of output with respect to inputs. For the purpose of this present study, the functional relationship between manufacturing output and capacity utilisation is expressed below:

$$MANO_t = f(CU_t, GCF_t, LAB_t) \qquad (4)$$

Where, $MANO_t$ represents manufacturing output at time t, GCF_t is the gross capital formation at time t. while LAB_t represents labour force participation rate at time t CU_t represents capacity utilisation rate at time t. Capacity utilisation rate affects efficiency level or rate of technology of production.

However, there is an evolution in the economic behaviour of countries over time and a dynamic model is therefore required to explain the relationship among variables (Ellahi, 2011). Thus, an Autoregressive Distributed Lag (ARDL) model was developed to explore the effect of capacity utilisation on manufacturing firms' output. Pesaran, Shin & Smith (1997, 1999, 2001) have developed Autoregressive Distributed Lag (ARDL) model which has more advantages than the Johansen cointegration approach and other previous approaches. The ARDL approach can be applied irrespective of whether the regressors are purely I(1) or purely I(0) or the combination of I(1) and I(0). It also avoids the problem of biasness that arise from small sample size. Based on this, the autoregressive distributed lag model from equation 4 is specified below:

$$\Delta \ln MANO_t = \alpha + \sum_{j=1}^{p} \theta_j \Delta \ln MANO_{t-j} + \sum_{j=0}^{p} \beta_j \Delta \ln CU_{t-j} + \sum_{j=0}^{p} \delta_j \Delta GCF_{t-j} + \sum_{j=0}^{p} \sigma_j \Delta \ln LAB_{t-j} + \lambda_1 \ln MANO_{t-1} + \lambda_2 \ln CU_{t-1} + \lambda_3 \ln GCF_{t-1} + \lambda_4 \ln LAB_{t-1} + \varepsilon_t \quad (5)$$

c) Technique of Analysis and Sources of Data

It is essential to determine the order of integration of each of the variable series in order to avoid spurious regression; and to employ autoregressive distributed lag (ARDL) method. Although, the ARDL test does not necessarily require the pretesting of variables but the unit root test provides guidance as to whether ARDL is applicable or not because it is only applicable to the analysis of variables that are integrated of order zero [I(0)] or order one [I(1)] or combination of both, but not applicable when higher order of integration such as I(2) variable is involved (Nyasha and Odhiambo, 2014). Thus, the Augmented Dickey-Fuller (ADF) of Dickey and Fuller (1981) and Phillp-Perron techniques were used to investigate the stationarity of the variables. To achieve the objective of the study, equation (7) was analysed to examine the effect of capacity utilisation on manufacturing firms' output in Nigeria.

Annual data on manufacturing value added as a percentage of GDP (a proxy for manufacturing firms' output), gross capital formation, labour force participation rate were sourced from World Development Indicator (WDI), 2016 edition while capacity utilisation rate was sourced from the Publication of Central Bank of Nigeria's (CBN) Statistical Bulletin, 2016 edition.

V. Results and Interpretations

a) Descriptive Statistics

The statistical description of the variables has become vital to observe the distribution, variability and normality of the variables with a view to overcoming the likely problems associated with time series data. Table 2presents the descriptive characteristics of the variables. In Table 1,the mean and median values lie within their maximum and minimum values for variables which indicate a good level of consistency. Manufacturing firm's output (MANO) is the least volatile variable while labour force participation rate (LAB) is the most volatile variable.

Moreover, the skewness statistics reveal that only labour force participation rate (LAB) is negatively skewed while other variables are positively skewed. The kurtosis statistics show that only gross capital formation (GCF) exceeds 3, meaning that the series is leptokurtic (peaked) relative to normal distribution while other variables are platykurtic since their respective kurtosis is less than 3, which implies that its distribution is flatter relative to normal distribution. Finally, the overall probability that the Jarque-Bera statistic exceeds5% (in absolute value) significance level for all the series suggests the rejection of the null hypothesis of normal distribution at 5% significance level as the observed values are generally low for all the series.

Table 1: Descriptive characteristics of Data set

	Mano	Cu	Gcf	Lab
Mean	6.235459	47.17258	2.83E+12	42.18691
Median	5.727706	46.75000	2.43E+11	55.80000
Maximum	10.65402	73.30000	1.61E+13	57.70000
Minimum	2.410130	29.29355	7.99E+09	0.000000
Std. Dev.	2.639774	11.04581	5.00E+12	24.71454
Skewness	0.158520	0.095055	1.641042	-1.151220
Kurtosis	1.782473	2.122804	4.042237	2.330663
Jarque-Bera	2.374328	1.208422	17.78750	8.623863
Probability	0.305085	0.546505	0.000137	0.013408

Source: Author's Computation, 2017

b) Unit Root Test

The results of the unit root test for the variables used in the study are as shown in table 2. The table shows the Augmented Dickey-Fuller (ADF) and Phillips-Perron (PP) tests results.

Table 2: Unit Root Test Results

	ADF			PP		
Variable	Level	First Diff	Status	Level	First Diff	Status
LMANO	-1.3213	-5.7517*	I(1)	-1.5307	-5.7755*	I(1)
LCU	-1.8082	-3.5055*	I(1)	-2.1435	-3.5055*	I(1)
LGCF	0.6264	-4.7605*	I(1)	0.5847	-4.8047*	I(1)
LLAB	-1.7533	-5.8292*	I(1)	-1.7459	-5.8297*	I(1)

Source: Author's Computation, 2017

The results of the unit root tests in table 1 shows that manufacturing value added as a percentage of GDP, gross capital formation, labour force participation rate and capacity utilisation rate are all stationary at first difference in both Augmented Dickey-Fuller and Phillips-Perron tests.

c) Lag Length Criteria

Table 3 presents the maximum lag length selected by Information Criteria. All information Criteria depict optimal lag length of 1 except Akaike Information Criterion (AIC) which indicates optimal lag length 2. However, the stability of the model was tested via inverse root of AR polynomial and cumulative sum, and the model was found to be stable at lag length 2 (*see figure 2 and 3*), therefore Akaike Information Criterion (AIC) prediction was adopted for the purpose of our estimation.

Table 3: Lag Order Selection Criteria

Lag	Logl	LR	FPE	AIC	SC	HQ
0	-10.83306	NA	2.89e-05	0.898973	1.080368	0.960007
1	126.8966	233.7230*	1.82e-08*	-6.478579	-5.571605*	-6.173410*
2	143.1563	23.65052	1.88e-08	-6.494321*	-4.861767	-5.945016
3	151.6781	10.32948	3.35e-08	-6.041098	-3.682965	-5.247658

*Source: Author's Computation, 2017 Note: * indicates lag order selected by the criterion; LR, FPE, AIC, SIC and HQ indicate sequential modified LR test statistic, Final Prediction Error, Akaike Information Criterion, Schwartz I nformation Criterion and Hannan-Quinn respectively.*

d) Effect of Capacity Utilisation on Manufacturing Firm's Output in Nigeria

In order to examine the effect of capacity utilisation on manufacturing firm's output in Nigeria, ARDL Model in equation 5was estimated. The results of the estimation was depicted in the Table 4. The result in Table 4 showed that capacity utilisation rate (CU) and labour force participation rate (LAB) did not conform to a priori expectation while gross capital formation (GCF) was positively related to manufacturing firm's output in Nigeria (MANO).

Table 4: Result of ARDL Model (1,1,1,2)

Dependent Variable: LMANO				
Variable	Coefficient	Std. Error	t-Statistic	Prob.*
LMANO(-1)	0.827359	0.118696	6.970403	0.0000*
LCU	1.156706	0.973014	1.188787	0.3382
LCU(-1)	0.703021	0.421922	1.666233	0.1081
LGCF	0.304734	0.141556	2.152742	0.0412*
LGCF(-1)	-0.193940	0.146645	-1.322507	0.1980
LLAB	-0.067723	0.058740	-1.152943	0.2598
LLAB(-1)	0.076954	0.072851	1.056316	0.3009
LLAB(-2)	-0.119101	0.060335	-1.973984	0.0595
C	-0.277132	0.296300	-0.935309	0.3586
R-squared	0.854126	Adjusted R-squared		0.807447
F-statistic	18.29765	Prob. (F-statistic)		0.000000
Durbin-Watson stat	2.360693			

Source: Author's Computation, 2017. indicate significance at 5%,* Contrary to a priori expectation, capacity utilisation rate has an nsignificant positive effect on manufacturing firm's output in Nigeria ($t=1.1888$; $p>0.05$). Other things being equal, a 1% increase in the capacity utilisation rate should lead to about 1.16% increase in manufacturing firm's output in Nigeria. Moreover, though not significant also, the previous year's capacity utilisation rate is positively related to present manufacturing firm's output in Nigeria ($t=1.6662$; $p>0.05$). Similarly, gross capital formation (GCF) has a positive effect on manufacturing firm's output in Nigeria ($t=2.1527$; $p<0.05$). An increase of 1% in GFC will lead to about 0.31% increase in manufacturing firm's output in Nigeria. However, labour force participation rate has a negative effect on manufacturing firm's output though not significant ($t=-1.1529$; $p>0.05$). The result shows that, 1% increase in the labour force participation rate reduces manufacturing firm's output by about 0.0677% in Nigeria.

The R^2 reveals the explanatory power of the independent variables. The result indicates that about 85% variations in the dependent variable are explained by independent variables in the model while the F-statistic shows that the independent variables are jointly significant in explaining the dependent variable (F-stat =18.29765, P-value=0.0000). The Durbin-Watson statistic showed that the model is free of serial correlation problem when compared to R Squared value [DW (2.360693) $>R^2$ (0.854126)].

e) Discussion of Findings

This result showed that Nigerian manufacturing firms are characterized with under utilisation of capacity which reflect in its insignificant effects on manufacturing output, and a number of factors might be responsible. Among these factors are foreign exchange shortage, preference for foreign products, high cost of equipment and machinery, power failure and maintenance culture. rejected. Thus, this necessitates the acceptance of null hypothesis and therefore concludes that the model has equal variance (homoscedastic). Also, Ramsey RESET test shows that the model is free of specification errors, The shortage of foreign exchange constitutes a significant problem towards the purchase of necessary raw materials and spare parts which could aid manufacturing firms and undermine their ability to run in full capacity. Preference for foreign product and uncoordinated imports of goods and services at the expense of locally produced goods is another important problem. Also, failure in power supply constitutes a substantial source of under utilisation, and moreover, a considerable loss of production is attached to power failure from time to time. Moreover, the negative relationship between labour force participation rate and manufacturing output reveals the consequence of moving towards a more capital intensive technique of production in an economy with overwhelmingly growing labour supply.

f) Diagnostic Tests

Testing for serial correlation, heteroskedasticity and stability of the model has become necessary in time series analysis to ensure a stable model, and to avoid making spurious inferences. Autocorrelation, simply put, explains a situation where a variable is influenced by its lagged values while heteroskedasticity has to do with the circumstance in which the variability of a dependent variable is unequal across the range of values of an independent variable that predicts it.

The Breusch-Godfrey Serial Correlation LM test result in Table 5 shows that the probability values (0.4386 and 0.3086) are greater than 0.05 levels of significance which imply that the null hypothesis of no serial correlation cannot be rejected. Thus, this necessitates the acceptance of null hypothesis and therefore concludes that the model has no serial correlation problem. Similarly, Breusch-Pagan-Godfrey heteroskedasticity test result in Table 5 shows that the probability values (0.4035, 0.3549 and 0.9719) are greater than 0.05 level of significance, and this implies that the null hypothesis of homoscedasticity can not be that is, relevant variables were not omitted, the functional form of the model is correct, and there is no serial correlation between the independent variables and disturbance term.

Table 5: Diagnostic Test Results

Breusch-Godfrey Serial Correlation LM Test			
F-statistic	0.85442	Prob. F(2,23)	0.4386
Obs*R-squared	2.35141	Prob. Chi-Square(2)	0.3086
Heteroskedasticity Test: Breusch-Pagan-Godfrey			
F-statistic	5.36333	Prob. F(8,25)	0.4035
Obs*R-squared	21.4828	Prob. Chi-Square(8)	0.3549
Scaled explained SS	17.4049	Prob. Chi-Square(8)	0.9719
Ramsey RESET Test	Value	Df	Prob.
t-statistic	1.404639	24	0.1729
F-statistic	1.973011	(1, 24)	0.1729

Source: Author's computation, 2018

g) Stability Test

The stability of the model is tested via Cumulative Sum of Recursive Residuals (CUSUM), Cumulative Sum of Squares of Recursive Residuals (CUSUMSQ) and Inverse Root of AR Characteristic polynomial tests.In Figure 2 and 3, the blue line is between the upper and lower limits (the two red lines), this implies that the model is stable when estimated at lag 2. Similarly, no root lies outside the unit circle (modulus), that is, all of the modulus of the complex root values are less than 1 in Inverse Root graph in Figure 4, it can therefore be concluded that the model at lag 2 satisfies the stability condition.

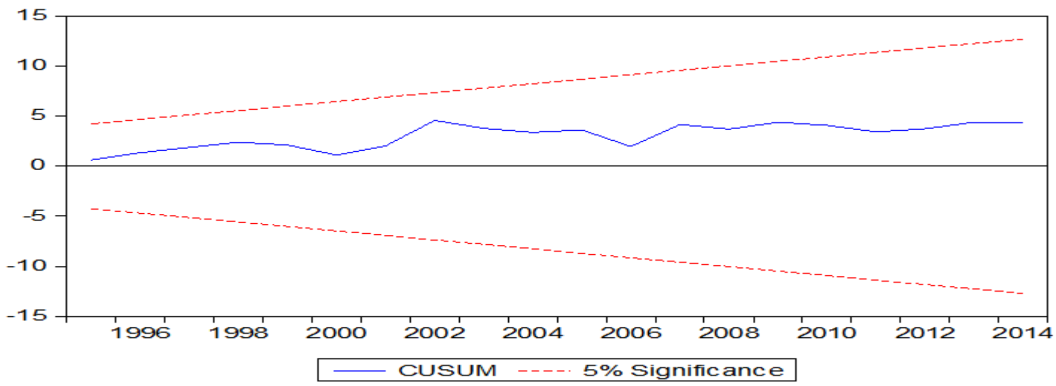


Figure 2: CUSUM test for Stability

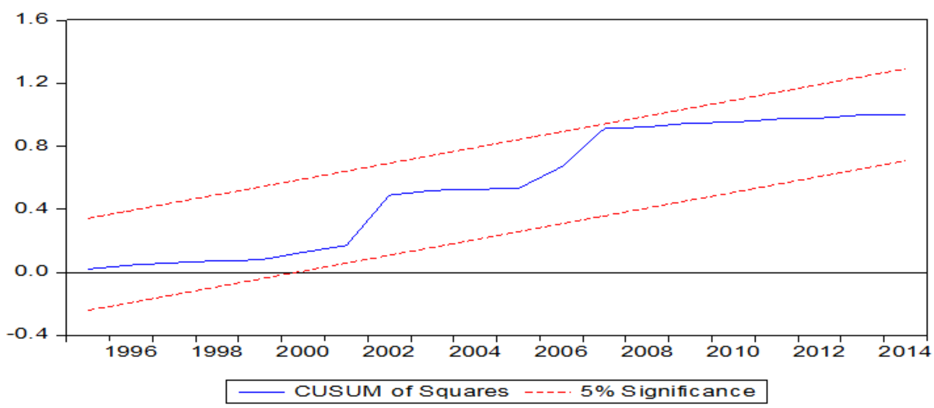


Figure 3: CUSUM of Square test for Stability

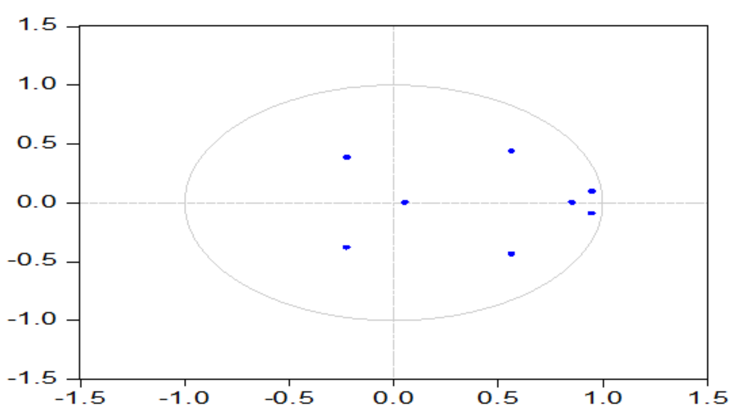


Figure 4: Inverse Roots of AR Characteristic Polynomial

VI. Conclusions and Policy Recommendation

The major conclusion of this study is that there is significant under utilisation of capacity in Nigerian manufacturing firms and this under utilisation makes positive effect of capacity utilisation less significant in explaining manufacturing firms' output growth in Nigeria. A number of factors have been responsibly identified for present under utilisation in the manufacturing firms. In line with the findings of this study, it is recommended that Nigerian government and policymakers should make policies that will ensure appreciation in foreign exchange rate to discourage uncoordinated imports of goods and services, to facilitate access to modern machineries with affordable cost implication, and make stable power supply a priority. These will increase capacity utilisation, and its positive effects will translate to increase in manufacturing firms' production in Nigeria.

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