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DETERMINANTS OF CAPACITY UTILIZATION IN THE NIGERIA MANUFACTURING SECTOR

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ABSTRACT

The study investigated determinants of capacity utilization in Nigeria's manufacturing sector. The objectives of the study were to determine effect of the determinants such as Consumer Price Index, Fixed Capital Formation, Electricity Generation Rate, and Real Fixed Capital Formation on the manufacturing utilization rate in Nigeria. The study utilized annual time series data for the period 1981 – 2019 which were obtained from the World Development Indicators (WDI) with the help of the Auto Regressive Distributive Lag (ARDL) model for analysis and estimation. The study key findings revealed that electricity power consumption had a positive significant relationship with average manufacturing capacity utilization rate in the current year and 1st year lag, but was insignificant on the long run at 5% level of significance; total labour force had a negative relationship with average manufacturing capacity utilization rate in the current year but was positive on the long run and significant at 5%; while lending interest rate had a positive significant relationship with average manufacturing capacity utilization rate in the current year but was insignificant in the long run at 5% level of significance. Based on these findings, the study recommended among others that stable electricity supply should be a policy focus if the manufacturing sector's desired output is to be achieved. Also, making low-interest credit available to manufacturers will go a long way to stimulate domestic production.

Key words: *Capacity Utilization; Electricity Power Consumption; Lending Interest Rate, Manufacturing Sector;*

1. INTRODUCTION

The manufacturing sector of an economy has always played, and will continue to play, a critical role in the rapid advancement of a rising economy. The relative importance of small and medium-sized enterprises, which make up the bulk of businesses in developing countries like Nigeria, has historically played a key role in accelerating growth and development in countries where their importance has been prioritized in economic planning strategies.

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According to Aremu (2004), manufacturing enterprises play a critical role in the economy of any country, depending on its relative level of development. Furthermore, Gunu (2004) and Aremu (2010) claimed that manufacturing industries, particularly small and medium-sized ones, generate personal income, savings, job possibilities, and propel the real sector of a rising economy. These businesses are seen as the locomotives that propel entrepreneurial talents and local technical improvements that are required for capacity utilization.

Manufacturing sector growth and capacity utilization are two connected phenomena such that the more the capacity utilized, the larger the outputs produced, and the faster the rise of manufacturing productivity or output. After gaining political independence in October 1960, Nigeria focused extensively on the manufacturing sector in the late 1970s and early 1980s, with the goal of achieving economic and social independence.

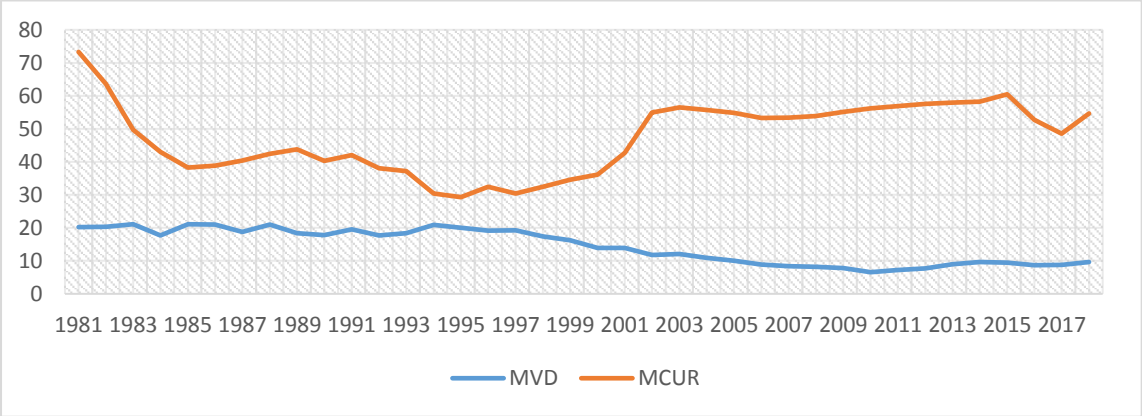


Figure 1. Trend Movement of Manufacturing Value Added (MVD) and Manufacturing Capacity Utilization Rate. *Source*: Researcher's Compilation

Manufacturing capacity utilization was 73.3 percent in 1981, with manufacturing value added to gross domestic product at 20.3 percent, but by 1995, manufacturing capacity utilization had dropped to 29.29 percent as electricity supply to manufacturing plants became erratic, roads were in poor condition, and the safety of manufacturers, for instance, bots, had become a concern. However, from 2003 and 2014, the average capacity utilization rate was quite low at 54 percent and grew to 60.5 percent with a 9.4 percent contribution to GDP, indicating that the manufacturing sector has had a very limited impact. Any economy's manufacturing sector can become a major driver of growth if it is adequately established. However, it is regrettable that the industry has underperformed expectations in Nigeria, resulting in a drop in industrial productivity and a contribution of less than 5% to the country's Gross Domestic Product (Udoh & Ogbuagu, 2012).

Establishing the conditions for strong economic growth at home is the first step in creating an economic climate that promotes manufacturing competitiveness. Fostering a climate that encourages significant corporate investment, particularly in the manufacturing sector, necessitates a risk-free economic environment. The manufacturing sector,

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for example, is growing the Nigerian economy's gross domestic product, although its contribution looks to be lower than planned. No industry can operate at full capacity without sufficient energy, as a reliable power supply is the primary driver of technological and social progress. There is almost no business or area of human growth that does not require energy in some form or another - electricity, fuels, and so on.

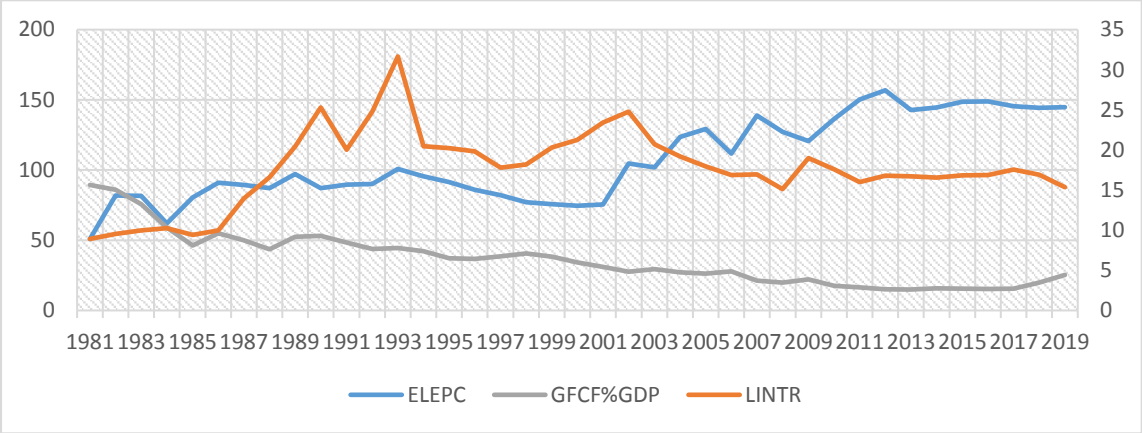


Figure 2. Trend Movement of Electricity Power Consumption Per Capita (ELPCP), Gross Fixed Capital Formation Percentage Contribution to GDP (GFCF_GDP) and Lending Interest Rate (LINTR) *Source*: Researcher's Compilation

Nigeria is endowed with a diverse range of energy resources, including crude oil, natural gas, coal, hydropower, solar energy, and fissionable materials for nuclear energy, but it consistently faces an energy shortage, which is a major impediment to the country's industrial and technological development. Looking at the diagram (fig 1.2) above, it appears that the amount of power consumed by each family has been steadily increasing over time. For example, in 1981, electricity consumption per capita was 51 kilowatts, rising to nearly 82 kilowatts in 1982. From 1983 to 2009, electricity consumption per capita fluctuated, reaching an all-time high of 157 kilowatts in 2012, which is still far below the standard requirement of ensuring a steady power supply in the country. The average power consumption in Nigeria is insufficient to maintain manufacturing enterprises' plants and machines operating at optimal levels, forcing them to rely on fossil fuel alternatives to power their plants and machines (Adegbamigbe, 2007 & Ajanaku, 2007).

Another determinant of capacity utilization in Nigeria's manufacturing sector is interest rate, which is a monetary policy tool and has long been a source of concern for monetary policymakers and investors. The working of interest rates is heavily influenced by the level of activity in an economy's manufacturing sector. The rate of interest involved in obtaining funds from banking institutions determines investment in the manufacturing sub-sector. Yet, as significant as interest rates are, the monetary authority is concerned by their tendency to exhibit unpredictable behavior, i.e., they fluctuate too much, as shown in the figure above. From 1981 to 1986, the loan rate fluctuated too much. The interest rate was approximately 9.5 to 9.8% in the early 1990s, but it climbed to 20.04 percent in 1991 and 32 percent in 1993. Higher interest rates tend to limit credit growth, making it more difficult for

firms to obtain financing and produce at their maximum capacity, as well as for individuals to find and hold work.

Capital formation is also a factor that influences the manufacturing sector's capacity utilization. Capital formation affects economic growth through determining the industrial sector's capacity to produce. The most important limitation to long-term economic growth has been identified as a lack of capital. In the meantime, understanding the impact of capital formation is a necessary precondition for planning a policy intervention aimed at achieving economic growth. According to Jhingan (2006), the process of capital formation involves three interrelated conditions: (a) the existence of real savings and their growth; (b) the existence of credit and financial institutions to mobilize savings and direct them to desired channels; and (c) the use of these savings for capital goods investment. In 1986, the Nigerian government recognized the need for increased capital formation and embarked on an economic reform that turned the focus to the private sector. The public sector reforms were anticipated to ensure that interest rates were positive in real terms and that savings were encouraged, ensuring that investment funds for the manufacturing sector were freely available. Aside from that, the reforms were supposed to boost labor productivity and efficiency, as well as the efficient use of economic resources, raise aggregate supply, reduce unemployment, and provide a low inflation rate. For example, gross fixed capital formation in Nigeria averaged 89.4 and 86 percent of GDP in 1981 and 1982, respectively, before dropping to the lowest average of 14.90 percent of GDP in 2013. The above chart in fig 2 above illustrates that the government has been neglectful in the field of capital accumulation, since the expenditure profile has shifted more to recurrent rather than capital expenditures in recent years. She didn't spend much of her capital on capital goods like machinery, instruments, or factories, or on increasing the stock of raw materials, completed goods, or bettering general investments. That isn't good enough for a country that is trying to develop.

Finally, the importance of deposit money bank credits in the efficient and effective performance of the manufacturing sector cannot be overstated, which is why one of the broad policy objectives of the Federal Government's Appropriation Bill in recent years has been to achieve a high economic growth rate, i.e. GDP of at least 5%, by better mobilizing and prudently using economic resources. Banks must be efficient mediators in mobilizing and channeling deposits to the productive sector of the economy, particularly manufacturing. Despite ongoing regulatory efforts to attract credit to the manufacturing sector, Nigerian manufacturing firms remain undesirable for deposit money bank loans with low interest rates (Ogar, Nkamare, & Effiong,. 2014). According to the central bank of Nigeria's 2009 report, commercial banks' loans and advances to the manufacturing sector have consistently departed from mandated minimums practically throughout the regulatory era.

Despite the fact that manufacturing firms' contribution is widely acknowledged, industrialists nonetheless confront several obstacles that limit their progress and survival. Because manufacturing activities can only thrive in a good investment environment, such as stable financial market systems for accessing credits at low rates of interest, and affordable corporate tax, little work has been done in the Nigerian manufacturing industry until recently, especially in terms of the

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components and determinants of full or optimal capacity utilization.

The unpredictable performance of Nigeria's industrial sector has harmed the economy's growth and, as a result, exacerbated the unemployment and crime rates. It has also increased demand for imported commodities, making the domestic economy highly vulnerable to changes in overseas prices. Basically, the manufacturing sector's poor performance has been attributed to the banking sector's unwillingness to appropriately support the manufacturing sector (Levine, 1997; Hassan, Sanchez & Yu, 2011).

Furthermore, the central bank's monetary policy and the government's trade policies have not been supportive of the industrial sector. The financial sector is, after all, expected to be a primary driving force boosting output and engineering the expansion of manufacturing companies, which may be done by making financing available to manufacturers at a cheap interest rate in order to cut operating costs and enhance productivity. However, emerging countries, particularly Nigeria, have failed to do this, and the manufacturing sector has virtually disappeared, contributing very little to the economy in terms of output and jobs (Shahbaz, 2009).

The challenges confronting Nigeria's manufacturing sector are simply due to the country's inability to develop suitable machines and technology on its own, its overreliance on foreign technology, and a lack of capital to acquire it, and as a result, the country's technology base is so weak due to insufficient investment in research, innovation, and development. Furthermore, the sector's mistreatment and malfunctioning as a result of poor financing, epileptic power supply, dilapidated and obsolete infrastructure, insufficient capital accumulation, high-interest rates, and persistent inflation, perennial security challenges, smuggling, and massive importation of capital goods can all be considered major determinants of capacity utilization.

1.1 Objectives

Broadly, this study intends to determine the effect of selected determinants on the capacity utilisation of the manufacturing sector in Nigeria. Specifically, the study intends to determine the:

1 effect of Electricity Power Consumption Per Capita, Consumer Price Index, Total labour Force, Lending Interest Rate, Goods Importation, Gross Fixed Capital Formation and Bank Credit to the Manufacturing Sector on Average Manufacturing Capacity Utilization in Nigeria.

1.2 Hypotheses

H_o: Electricity Power Consumption Per Capita has no siginificant effect on the Average Manufacturing Capacity Utilization in Nigeria.

H_o: Consumer Price Index has no siginificant effect on the Average Manufacturing Capacity Utilization in Nigeria.

H_o: Total labour Force has no siginificant effect on the Average Manufacturing Capacity Utilization in Nigeria.

H_o: Lending Interest Rate has no siginificant effect on the Average Manufacturing Capacity Utilization in Nigeria.

H_o: Goods Importation has no siginificant effect on the Average Manufacturing Capacity Utilization in Nigeria.

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H_o: Gross Fixed Capital Formation has no siginificant effect on the Average Manufacturing Capacity Utilization in Nigeria.

H_o: Bank Credit to the Manufacturing Sector has no siginificant effect on the Average Manufacturing Capacity Utilization in Nigeria.

2. LITERATURE REVIEW

2.1 Concept of capacity utilisation

This concept has no universally accepted meaning. This is due to the fact that different disciplines, such as political economy and organizational development, have diverse perspectives on capacity concerns. Capacity Utilization (CU) and capacity are difficult to define, let alone interpret and quantify consistently and consistently. Understanding capacity use and measuring it is essential for correctly designing a capacity management program, particularly when capacity utilization is controlled by specific constraints (Kirkley, James & Dale 2002). Capacity utilization perception is fundamentally linked to output. CU is frequently mentioned in discussions of applied and theoretical issues at both the macro and microeconomic levels, as its significance for business decision-makers grows. Excess capacity among enterprises, for example, indicates that there are components of monopolistic tendencies within certain industries (Ezu, Gideon, Sarah, Anyeneh, Ogbonnaya, 2019).

2.2 Empirical Review

Cassel (1937) is credited with the most important work on the economic notion of capacity utilization; he distinguished between excess capacity of fixed elements (short run cost curves) and excess capacity of all factors (long run cost curves). Cassel went on to say that because the absolute technical upper limit of output obtained from fixed factors is unlikely to be within the domain of actual economic operations, capacity output should be defined as the output at which average total costs are at their lowest.

Various studies on manufacturing capacity utilization, its causes, and how it affects growth in various economies throughout the world have been undertaken. However, a number of these studies have been identified as necessary for developing research on industrial capacity use.

Edeme, Buzugbe, Nkalu, & Arazu (2020) assessed the effect of infrastructural development on manufacturing value added in the case of emerging African emerging economies. Empirical findings indicate that electricity, information and communication technology and electricity had positive and insignificant effect on manufacturing value added while transport had negative effect on manufacturing value added.

Opaluwa, Umeh, and Abu (2020), studied the effect of exchange rate fluctuations on the Nigeria manufacturing sector from 1986-2015 using ordinary least square method. The result revealed 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

Kida and Angahar (2020), carried out a study on industrialization and economic growth in Nigeria between 1981 and 2013 using ordinary least square with the help of the error correction mechanism. Their result revealed that manufacturing output has a positive significant impact on economic growth.

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Alematu, David, Ochugudu, and Audu (2020), carried out an investigation on stock market development and performance of the manufacturing sector in Nigeria between 1986 and 2019 using structural vector autoregressive (SVAR) method. Their result showed that market capitalization, stock market liquidity and total new issues have positive impact on the manufacturing output both in the short and long-run

Afolabi & Laseinde (2019), also examined manufacturing sector performance and economic growth in Nigeria between 1981 and 2016 using autoregressive distributed lag (ARDL) and revealed 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.

3. METHODOLOGY

The study developed an Auto Regressive Distributive Lag Model (ARDL) model to capture effect of the determinants of capacity utilization on manufacturing capacity utilization rate in Nigeria. Secondary data was sourced from World Development Indicators (WDI) of World Bank, while the design is ex-post facto. An ex-post facto research can be defined as an empirically based investigation which does not involve the researchers' direct control over the independent variables because they have already led to effects which can no more be manipulated. The conclusions regarding the relationship between the variables are inferred without intervening or varying the independent or dependent variable. It is a kind of research in which the researcher predicts the possible causes behind an effect that has already occurred and this is one the advantage of the ex-post facto because it tries to predict the causes on the basis of actions that have already occurred, the researcher cannot manipulate or change the already occurred actions or behavior.

3.1 Theories and Model Specification

The model of this study is anchored on three theories viz the Theory of Unbalanced Growth by Hirschman (1958), Lewis (1954) Theory of Unlimited Supplies of Labour and Kaldor (1967) Model of Economic Growth. According to Hirschman, rather than investing in all sectors at once, there is always a need to invest in strategic sectors of the economy because these major sectors will serve as a propeller of growth for other sectors, allowing for rapid development, and the revenue from these sectors will be used to develop other sectors, pointing to the fact that underdeveloped countries have low per capita income. According to Lewis (1954), underdeveloped countries are characterized by overcrowded labour at subsistence wages, and development can occur when this excess labour is transferred from the agricultural dominant sector to the industrial dominant sector while maintaining a zero marginal labour rate (Jhingan, 2013), resulting in the creation of new industries. Finally, according to Kaldor (1954), moving labour into more productive manufacturing sectors is the only way to increase a poor country's economic growth and development. Similarly, a developing manufacturing sector can lead to long-term growth and development, whereas a small or non-existent manufacturing sector might lead to a country's bad growth.

As a result, the model for this study is based on Adeyemi and Olufemi (2016)'s work, where they used Manufacturing

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Capacity Utilization as the dependent variable and the consumer price index, fixed capital formation in manufacturing, electricity generation rate, and real manufacturing output growth as independent variables:

MCU(Y) = F (CPI, FCF, ELECGR, RMOG)……Eqn 1

Where CPI denotes Consumer Price Index, FCF denotes Fixed Capital Formation, ELECGR denotes Electricity Generation Rate, and RMOG denotes Real Fixed Capital Formation.

There are two steps to the ARDL bounds testing technique. The Bounds test, which compares the F-statistic value to the I(0) and I(1) bounds, is used to test for a long-run relationship, followed by short-run parameter estimation using the dynamic Unrestricted Error Correction Model (UECM) by a simple linear transformation. The UECM blends the short-run dynamics with long-run equilibrium without compromising long-run information. As a result, the ARDL-UECM specification for equation II is as follows:

$$\Delta AMCUR_t = \alpha_0 + \sum_{i=1}^{n} \phi_1 \Delta AMCUR_{t-i} + \sum_{i=1}^{n} \phi_1 \Delta ELPCP_{t-J} + \sum_{i=1}^{n} \phi_1 \Delta lnGFCF_{t-K} + \sum_{i=1}^{n} \phi_1 \Delta LINTR_{t-L} + \sum_{i=1}^{n} \phi_1 \Delta lnGSIMP_{t-M} + \sum_{i=1}^{n} \phi_1 \Delta lnTLABF_{t-N} + \sum_{i=1}^{n} \phi_1 \Delta CPIND_{t-O} + \sum_{i=1}^{n} \phi_1 \Delta lnBCRMS_{t-p} + \beta_1 AMCUR_{t-1} + \beta_2 ELPCP_{t-1} + \beta_3 lnGFCF_{t-1} + \beta_4 LINTRt_{-1} + \beta_5 lnGSIMP_{t-1} + \beta_6 lnTLABF_{t-1} + \beta_7 CPIND_{t-1} + \beta_8 lnBCRMS_{t-1} \ldots\ldots$$ Eqn 2

Where,

AMCUR = Average Manufacturing Capacity Utilization Rate; ELPCP = Electricity Power Consumption Per Capita; lnGFCF = Natural Logarithm of Gross Fixed Capital Formation; lnGSIMP = Natural Logarithm of Goods Imported; lnTLABF = Natural Logarithm of Total Labour Force; lnBCRMS = Natural Logarithm of Bank Credit to Manufacturing Sector; LINTR = Lending Interest Rate; CPIND = Consumer Price Index as control variable; C_0 = Constant Variable or Intercept; Φ= Short Run Dynamic Coefficients of the Model's Convergence to Equilibrium; Δ = Short Run Dynamic Coefficients; Є = Error Term.

3.2 Decision Rule

The null hypothesis cannot be rejected when p-value is greater than 0.05 level of significance; otherwise reject and accept the alternate hypothesis.

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4. ANALYSIS AND DISCUSSION OF RESULTS

4.1. Pre-Estimation Test

4.1.1 Descriptive statistics

Table 1: **Common Sample Descriptive Statistics**

	AMCUR	CPIND	ELPCP	LINTR	lnBCRMS	lnGFCF	lnGSIMP	lnTLABF
Mean	47.27513	61.43816	106.8625	17.69646	4.641329	24.39614	23.31728	17.50248
Median	48.50000	29.60073	97.07071	17.55333	4.950815	24.29411	23.15999	17.53975
Std. Dev.	10.68479	73.00007	29.34191	4.793755	2.359293	0.632865	1.058888	0.291029
Skewness	0.083549	1.301195	0.211999	0.245573	-0.243924	0.157281	-0.054216	-0.309205
Kurtosis	2.250658	3.777908	1.762539	3.752934	1.607899	2.024579	1.790113	1.878624
Jarque-Bera	0.957833	11.98857	2.780514	1.313218	3.535903	1.706893	2.397823	2.664859
Probability	0.619454	0.002493	0.249011	0.518607	0.170682	0.425944	0.301522	0.263836

Source: Researcher's Extract from Eviews 11 2021. (Please See Appendix)

From Table 1, the result of the descriptive statistics showed that the standard deviation calculated for Consumer Price Index (CPIND), Electricity Power Consumption (ELPCP), and Average Manufacturing Capacity Utilization Rate (AMCUR) were the most volatile in the series with values of 73.0, 29.3 and 10.6 respectively while Total Labour Force (lnTLABF) and Gross Fixed Capital Formation (lnGFCF) were the least volatile variables with values of 0.29 and 0.63 respectively. The calculated values for the skewness statistics values of lnBCRMS, lnGSIMP and lnTLABF variables were negatively skewed, suggesting that their distributions have a long-left tail while the skewness statistics values for AMCUR, CPIND,ELPCP, LINTR, lnGFCF variables were positively skewed, suggesting that their distributions have a long right tail. Based on these observations, it therefore means that there is unit root (non-stationarity) in the series. Thus, estimating these variables at level might not give good results, hence, the need to conduct the unit root test.

4.1.2 Unit Root Test

A unit root test was performed on the selected time series data to assess whether they are stationary or non-stationary in level or first difference form, in order to evaluate the reliability of the time series data utilized for this investigation. The Augmented Dickey Fuller and Philip Perron unit root test is the unit root test that was used to ascertain the stationarity status of the time series. To establish the suitable test equation for the unit root test, the study reveals the trend movement of each of the variables of interest before the unit root summary for stationarity.

Table 2. Summary of Stationarity Test Using Augmented Dickey Fuller

Varaible	ADF Stat. (levels)	5% Critical value	Prob. Value	ADF. Stat. First Difference	5% Critical Value	Prob. Value	General remark
AMCUR	-1.698777	-3.544284	0.7305	-3.500841*	-2.951125	0.0141	@I(1)
CPIND	3.776757	-3.540328	1.0000	-5.609067*	-3.544284	0.0003	@I(1)
ELPCP	-3.633055*	-3.533083	0.0401	-	-	-	@I(0)
LINTR	-2.846115	-2.948404	0.0622	-2.667881*	-1.950687	0.0091	@I(1)
lnBCRMS	-0.323320	-3.533083	0.9870	-3.642437*	-3.548490	0.0409	@I(1)
lnGFCF	-4.171087*	-3.544284	0.0119	-	-	-	@I(0)

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lnGSIMP	-2.694232	-3.533083	0.2445	-5.989751*	-3.536601	0.0001	@I(1)
lnTLABF	-1.937262	-3.536601	0.6151	-4.222770	-3.536601	0.0101	@I(1)

Table 3. Summary of Stationarity Test Using Phillips-Perron Test Statistic

Varaible	**Phillips-Perron Test statistic (level)**	**5% critical value**	**Prob. Value**	**Phillips-Perron Test statistic (first difference)**	**5% Critical Value**	**Prob. Value**	**General remark**
AMCUR	-2.784889	-2.941145	0.0699	-3.788864*	-2.951125	0.0065	@I(1)
CPIND	19.21574	-2.941145	1.0000	-9.920087*	-3.540328	0.0000	@I(1)
ELPCP	-3.823457*	-3.533083	0.0260	-	-	-	@I(0)
LINTR	-0.197988	-1.949856	0.6083	-6.923732*	-1.950117	0.0000	@I(1)
lnBCRMS	-0.765074	-3.533083	0.9601	-4.717144*	-3.536601	0.0028	@I(1)
lnGFCF	-4.345087*	-3.533083	0.0073	-	-	-	@I(0)
lnGSIMP	-2.699736	-3.533083	0.2424	-5.996531*	-3.536601	0.0001	@I(1)
lnTLABF	-1.652654	-3.533083	0.7524	-4.222770*	-3.536601	0.0101	@I(1)

Source: Researcher's Compilation from Eviews 11 Regression Output (2021).

The aesteriks(*) sign is used to indicate stationarity at the 5% significance level

Based on the summary of unit root in Tables 2 (Augmented Dickey Fuller) and 3 (Phillips-Perron Test Statistic), the application of unit root tests in autoregressive distributed lag (ARDL) technique is necessary in order to ensure that the variables are integrated of order one and none of the variables is integrated of order 2 because the computed F-statistic provided by Pesaran & Shin (2001) are valid for only variables that are I(0) or I(1) and a combination of both. The outcome of the unit root test in Tables 3 and 4 indicated that AMCUR, ELPCP, lnGFCF were integrated of order I(0) while CPIND, LINTR, lnBCRMS, lnGSIMP, lnTLABF achieved stationarity at first difference, for instance, integrated of order I(1). Therefore, the variables under study are of mixed integration order and this justified the use of ARDL bounds test approach to co-integration over other conventional approaches that require the variables to be integrated of the same order.

4.1.3 Selection of Lag Length Criteria

Table 4 Lag Order Selection Criteria

VAR Lag Order Selection Criteria

Endogenous variables: AMCUR lnBCRMS ELPCP CPIND lnGFCF lnGSIMP lnTLABF LINTR

Lag	LogL	LR	FPE	AIC	SC	HQ
0	-531.9512	NA	1472.011	29.99729	30.34918	30.12011
1	-199.3349	498.9244	0.000530	15.07416	18.24120*	16.17954
2	-119.1994	84.58745	0.000381	14.17774	20.15993	16.26569
3	26.90615	89.28672*	2.77e-05*	9.616325*	18.41365	12.68683*

Source: Researcher's Extract from Eviews 11 Output.

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It is possible to find the proper lag periods in analyzing and estimating the required test for our model using the Vector Autoregressive Lag Length Criteria. Based on the lag length criteria listed above, it is clear that lag period 3 is the model's dominant and appropriate lag, as demonstrated by the Akaike Information Criterion (AIC) for estimate.

4.1.4 Cointegration Test

Table 5. Autoregressive Distributed Lag Bounds Test for Co-Integration

Test Statistic	Value	Significance	I(0)	I(1)
F-statistic	12.68015	10%	2.38	3.45
k	7	5%	2.69	3.83
		2.5%	2.98	4.16
		1%	3.31	4.63

Source: Researcher's Compilation from Eviews 11 Output.

From the ARDL bounds test in Table 5, and going by the decision rule of the Bounds Test, we cannot accept the null hypothesis of no cointegration since the F-Bounds Statistic of 12.68015 is greater than the I (0) and I (1) bounds at 10%, 5% and 1% respectively, therefore we conclude that there exists a long run relationship among the variables.

4.2 Dynamic Short Run ARDL Error Correction Model and Discussion

Table 6. Result of Dynamic Short Run ARDL Error Correction Model for determinants of capacity utilization in Nigeria's manufacturing sector.

ARDL Error Correction Regression				
Dependent Variable: D(AMCUR)				
Variable	**Coefficient**	**Std. Error**	**t-Statistic**	**Prob.**
C	3152.282	265.6502	11.86629	0.0000*
@TREND	3.005545	0.252870	11.88573	0.0000*
D(AMCUR(-1))	0.204166	0.078716	2.593709	0.0183**
D(AMCUR(-2))	0.296251	0.078181	3.789292	0.0013*
D(ELPCP)	0.180776	0.027100	6.670644	0.0000*
D(ELPCP (-1))	0.094471	0.027487	3.436893	0.0029*
D(CPIND)	-0.440880	0.103581	-4.256375	0.0005*
D(CPIND(-1))	1.191358	0.132143	9.015680	0.0000*
D(lnTLABF)	-187.5745	23.10913	-8.116897	0.0000*
D(lnTLABF(-1))	164.5526	22.12580	7.437136	0.0000*
D(LINTR)	0.944691	0.183326	5.153056	0.0001*
D(lnGSIMP)	3.950031	1.406154	2.809103	0.0116**
D(lnGFCF)	15.71013	3.127829	5.022693	0.0001*
D(lnBCRMS)	12.18927	3.404288	3.580564	0.0021*
ECM(-1)*	-0.880854	0.074210	-11.86973	0.0000*

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Source: Researcher's Extract from Eviews 11 Output Package
Key: * Significant at 1% level; ** Significant at 5% level.

Constant (C): From the regression result above in Table 6, the coefficient of the constant term is positive and significant and conforms to apriori expectation. The value of the constant term is 3152.282 and this shows that when other explanatory variables are held constant, AMCUR will increase by 3152.282 units.

Trend (T): The regression result above indicated that the variables of interest all have a positive significant strong trend property.

Average Manufacturing Capacity Utility Rate (AMCUR): AMCUR's short run coefficients are positive for the first and second lags, and statistically significant at the 5% level of significance, showing a substantial endogenous influence on itself by growing by 0.204166 and 0.204166 units, respectively.

Electricity Power Consumption Per Capita (ELPCP): The short run coefficients of electricity power consumption per capita have a positive relationship with AMCUR in the current year and 1st year lag, and are statistically significant at the 5% level of significance, indicating a strong influence on AMCUR by increasing AMCUR by 0.180776 and 0.094471 units on average, respectively.

Consumer Price Index (CPIND): Analysis of the short run coefficients of consumer price index has a negative relationship with AMCUR in the current year but positive in the 1st year lag and also statistically significant at 5% level of significance indicating a strong negative influence on AMCUR by decreasing AMCUR significantly by 0.440880 units in the current year and significantly increasing AMCUR by 1.191358 units in the 1st lag respectively on the average.

Total Labour Force (lnTLABF): Analysis of the short run coefficients of total labour force has a negative relationship with AMCUR in the current year but positive in the 1st year lag and also statistically significant at 5% level of significance indicating a strong negative influence on AMCUR by decreasing AMCUR significantly by -187.5745 units in the current year and significantly increasing AMCUR by 164.5526 units in the 1st year lag respectively on the average.

Lending Interest Rate (LINTR): Analysis of the short run coefficients of Lending Interest Rate has a positive relationship with AMCUR in the current year and also statistically significant at 5% level of significance indicating a strong positive influence on AMCUR by increasing AMCUR significantly by 0.944691 units on the average.

Goods Importation (lnGSIMP): Analysis of the short run coefficients of goods importation has a positive relationship with AMCUR in the current year and also statistically significant at 5% level of significance indicating a strong positive effect on AMCUR by increasing AMCUR significantly by 3.950031 units on the average

Gross Fixed Capital Formation (lnGFCF): Analysis of the short run coefficients of gross fixed capital formation has a positive relationship with AMCUR in the current year and also statistically significant at 5% level of significance indicating a strong positive

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influence on AMCUR by increasing AMCUR significantly by 15.71013 units on the average.

Bank Credit to Manufacturing Sector (lnBCRMS): Analysis of the short run coefficients of bank credit to manufacturing sector has a positive relationship with AMCUR in the current year and also statistically significant at 5% level of significance indicating a strong influence on AMCUR by increasing AMCUR significantly by 12.18927units on the average.

Error Correction Mechanism ECM (-1) The Error correction mechanism met the required conditions. The significance and rule of ECM holds that negative and statistical significant error correction coefficients are necessary conditions for any disequilibrium to be corrected. In light of this, the coefficient of ECM (-1) is -0.880854. The above result shows that the ECM (-1) value is -0.88% implying that there is convergence of the equilibrium should there be system disequilibrium. The negative sign of the coefficient satisfied one condition while the fact that its P-value [0.0000] is less than 5% [0.05] level of significance satisfied the second condition of statistical significance. The coefficient indicates that the speed of adjustment between the short run dynamics and the long run equilibrium is 88%, thus, ECM will adequately act to correct any deviations of the short run dynamics to its long-run equilibrium by 88% annually on the average.

4.3 ARDL Long Run Form For Determinants Of Capacity Utilization In Nigeria's Manufacturing Sector

Table 7. Static Long Run Estimates for Determinants of Capacity Utilization in Nigeria's Manufacturing Sector

Variable	Coefficient	Std. Error	t-Statistic	Prob.
lnBCRMS	13.83802	3.912316	3.537040	0.0024*
ELPCP	0.060388	0.053865	1.121093	0.2770
CPIND	-0.254598	0.070284	-3.622423	0.0019*
lnGFCF	17.83512	3.007596	5.930025	0.0000*
lnGSIMP	4.484322	1.249551	3.588747	0.0021*
lnTLABF	-241.1746	38.97045	-6.188653	0.0000*
LINTR	1.072472	0.237197	4.521436	0.0003*
R-squared	0.899423	Mean dependent var		-0.163889
Adjusted R-squared	0.859193	S.D. dependent var		4.206405

Source: Researcher's Extract from Eviews 11 Output Package

Key: * Significant at 1% level; ** Significant at 5% level.

Bank Credit to Manufacturing Sector (lnBCRMS): The long run estimates of Bank Credit to Manufacturing Sector had a positive relationship with Average Manufacturing Capacity Rate increasing AMCUR by 13.83802 units significantly on the average.

Electricity Power Consumption Per Capita (ELPCP): The long run estimates of Electricity Power Consumption Per Capita had a positive relationship with

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Average Manufacturing Capacity Rate while decreasing AMCUR by 0.060388 units significantly on the average.

Consumer Price Index (CPIND): The long run estimates of Consumer Price Index had a negative relationship with Average Manufacturing Capacity Rate decreasing AMCUR by 0.254598 units significantly on the average.

Gross Fixed Capital Formation (lnGFCF): The long run estimates of Gross Fixed Capital Formation had a positive relationship with Average Manufacturing Capacity Rate increasing AMCUR by 17.83512 units significantly on the average.

Goods Importation (lnGSIMP): The long run estimates of Goods Importation had a positive relationship with Average Manufacturing Capacity Rate increasing AMCUR by 4.484322 units significantly on the average.

Total Labour Force (lnTLABF): The long run estimates of Total Labour Force had a negative relationship with Average Manufacturing Capacity Rate decreasing AMCUR by 241.1746 units significantly on the average.

Lending Interest Rate (LINTR): The long run estimates of Goods Importation had a positive relationship with Average Manufacturing Capacity Rate increasing AMCUR by 1.072472 units significantly on the average.

Electricity Power Consumption Per Capita (ELPCP), Goods Importation (lnGSIMP), Gross Fixed Capital Formation (lnGFCF), Bank Credit to Manufacturing Sector (lnBCRMS), and Lending Interest Rate (LINTR) account for 89 percent of the total variation in capacity utilization as captured by Average Manufacturing Capacity Utilization Rate (AMCUR). The total variation in the dependent variable of 10%, on the other hand, is due to the influence of additional factors not included in the regression model.

4.4 Diagnostic Test/Post Estimation Test

4.4.1 Breusch-Godfrey Serial Correlation LM Test

The standard errors and variances of the variables estimated in the model are affected by serial correlation in the error term, confounding inference. The study used a serial correlation LM check for autocorrelation in the error term entering the model to prevent this problem. The test's outcome is shown in the table below.

Table 8. Result Breusch-Godfrey Serial Correlation LM Test

Breusch-Godfrey Serial Correlation LM Test:			
Null hypothesis: No serial correlation at up to 2 lags			
F-statistic	1.778237	Prob. F(2,28)	0.1875
Obs*R-squared	4.282671	Prob. Chi-Square(2)	0.1175

Source: Researcher's Extract from Eviews 11 Output package.

From Breusch-Godfrey Serial Correlation LM Test table, the null hypothesis of no serial correlation cannot be rejected as the p-value from the LM serial correlation test is 0.1175 > 0.05 level of significance indicating an acceptance of the null hypothesis.

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4.4.2 Breusch-Pagan-Godfrey Heteroskedasticity Test

Table 9. Result of Breusch-Pagan-Godfrey Heteroskedasticity Test

Heteroskedasticity Test: Breusch-Pagan-Godfrey			
Null hypothesis: Homoskedasticity			
F-statistic	1.103359	Prob. F(17,18)	0.4179
Obs*R-squared	18.37075	Prob. Chi-Square(17)	0.3658
Scaled explained SS	5.051043	Prob. Chi-Square(17)	0.9976

Source: Researcher's Extract from Eviews 11 Output package.

From Breusch-Pagan-Godfrey Heteroskedasticity result, the null hypothesis of no serial correlation cannot be rejected as the p-value from the Heteroskedasticity Test is 0.9976 > 0.05 level of significance indicating an acceptance of the null hypothesis.

4.4.3 Stability Test

4.4.3.1 Ramsey Reset Test

The Ramsey Regression Equation Specification Error Test (RESET) is a general linear regression model specification test. It examines if non-linear combinations of the fitted values aid in the explanation of the response variable.

Table 4.10. Result of Ramsey Reset Test

Ramsey RESET Test			
	Value	df	Probability
t-statistic	1.125509	17	0.2760
F-statistic	1.266771	(1, 17)	0.2760
Likelihood ratio	2.587330	1	0.1077

Source: Researcher's Extract from Eviews 11 Output package.

From the RESET test result, the null hypothesis of no specification error cannot be rejected as the p-value from the RESET test is 0.2760 > 0.05 level of significance indicating an acceptance of the null hypothesis.

4.4.3.2 Cumulative and Cumulative Squares Test

The cusum and cusum of squares for model stability was employed to check for the stability of the parameters in the model. The result of the stability test is shown below:

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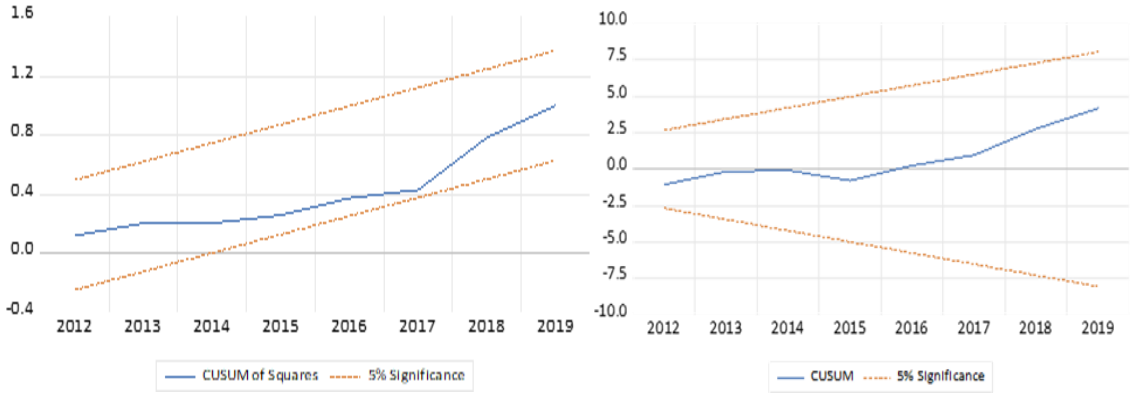


Figure 4.9. Cusum test for model stability and Cusum of Squares for model stability

The cusum and cusum squares diagrams shows that the model is stable as the cusum line lies in between the 5% boundary.

4.5. Discussion of Findings

4.5.1 Effect of Electricity Power Consumption Per Capita on Average Manufacturing Capacity Utilization in Nigeria.

Electricity Power Consumption Per Capita (ELPCP) was found to have a positive relationship with AMCUR in the current year and 1st year lag, as well as being statistically significant at the 5% level of significance, indicating a considerable influence on AMCUR but insignificant in the long run at 5%. This is unsurprising, given that power is a prerequisite for industrial growth and activity. When it comes to manufacturing companies' energy use and long-term growth, there are a number of major concerns, particularly in emerging countries like Nigeria. Such issues range from the increased cost of energy processes due to inefficient utilization, vulnerability to price shocks of imported fuels, and widespread inefficient and unclean energy use, both at the local and national level, as well as at the regional and global level, where manufacturing industries find it difficult to operate without adequate electricity supply. In his study of energy consumption and economic growth using 21 African countries as the scope of study encompassing the period 1970 to 2006, Eggoh (2018) backed up this finding where the use of ARDL bound test analysis revealed that GDP and electricity consumption had a long-run equilibrium relationship.

4.5.2 Effect of Consumer Price Index on Average Manufacturing Capacity Utilization in Nigeria.

Consumer Price Index (CPIND) was found to have a negative relationship with AMCUR in the current year but positive in the 1st year lag and also statistically significant at 5% level of significance indicating a strong negative influence on AMCUR but was insignificant in the long run at 5%. Inflation being a domestic phenomenon exists and does not cause much distortion in the economy if well managed. In fact, a good amount of inflation is required for an economy to estimate investment expenditure, but its transmission mechanism is through financial intermediaries and in turn affects interest rate which crowds-out investment and in turn, affects output in the long-run. The work of Osuala et al. (2013) gave credence to this study when they found a statistically significant positive relationship between inflation and

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economic growth for Nigeria, but no causality between inflation and growth. But, Olu and Idih (2015) who employed the ordinary least square (OLS) technique in estimating the multiple regression model argued that the relationship between these two variables are indeed positive, but non-significant.

4.5.3 Effect of Total labour Force on Average Manufacturing Capacity Utilization in Nigeria.

Total Labour Force (lnTLABF) was found to have a negative relationship with AMCUR in the current year but positive in the 1st year lag and also statistically significant at 5% level of significance indicating a strong negative influence on AMCUR and also statistically insignificant in long run on the average. Labour or human capital is in limited and in scarce quantity. For labour to be used efficiently, it warrants the acquisition of knowledge, skills, and capabilities that employers need in our current economic times and knowledge-driven economy which Nigeria has struggled over the years to invest in human capital. An individual's employability is of high importance since it not only provides gainful employment but it is also a contributing factor to the individual's personal well-being and growth whereby a lack of employability contributes to both frictional and structural unemployment and affects the productivity of the labour force.

4.5.4 Effect of Lending Interest Rate on Average Manufacturing Capacity Utilization in Nigeria

Lending Interest Rate (LINTR) was found to have a positive relationship with average manufacturing capacity utilization in the current year and also statistically significant at 5% level of significance indicating a strong influence on average manufacturing capacity utilization and also positive and significant in the long run. This finding is not surprising since interest rate can be used as an automatic stabilizer where it can be used by the monetary authorities to increase the level of economic activities hence, aggregate investment through making more funds available to potential investors in the country by reducing the rate of interest. For manufacturing investment, the real interest rate is important for determining the viability of investment. At lower interest rates, the marginal efficiency of capital increases. This means when it is cheaper to borrow, more investment projects are likely to give a return greater than the cost of debt interest payments, also, high interest rates may encourage firms to save cash rather than invest, as they can make a good return from just putting money in a bank. At lower interest rates, firms have less incentive to save. Okoye (2006) gave credence to the finding who examined the effect of interest rate on productive activities in Nigeria using data on selected manufacturing industries. The study showed evidence of positive effect of interest on manufacturing output.

4.5.5 Effect of Goods Importation on Average Manufacturing Capacity Utilization in Nigeria.

Goods Importation (lnGSIMP), was found to have a positive relationship with average manufacturing capacity utilization in the current year and also statistically significant at 5% level of significance indicating a strong influence on average manufacturing capacity utilization and also supported average manufacturing capacity utilization positively in the long run. The advantages of imported food include better quality, better-tasting food when it is sourced from a nation where it is locally grown. Though modern

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techniques like hydroponics make it possible to grow food anywhere, growing food outside of its native environment will likely produce a subpar product. The advantages of imported food are also economical. Importing food from its native country may mean prices are more affordable as the supply is higher than growing it locally. A key reason that companies all over the world choose to import goods is to extend their profit margin. High taxes, wage minimums, and material costs in certain countries make it more useful to import products from a country where fees, wages, and material costs are considerably lower. Certain products can cost upwards of 50% less to grow, manufacture or produce abroad. This situation is particularly common when importing goods where natural resources are abundant.

4.5.6 Effect of Gross Fixed Capital Formation on Average Manufacturing Capacity Utilization in Nigeria

Gross Fixed Capital Formation (lnGFCF) was found to have a positive relationship with average manufacturing capacity utilization in the current year and also statistically significant at 5% level of significance indicating a strong positive influence on average manufacturing capacity utilization and also supported average manufacturing capacity utilization positively on the long run. Capital formation can influence economic development through its effects on price level. Theoretically it is assumed that Inflationary pressure on a developing economy can be removed to a considerable extent by increase in capital formation. The output of manufactured consumer goods tends to increase with a rise in the rate of capital formation. On the other hand, when income increases with capital formation, it increases the demand for goods. In the short-run, it is not possible to match this increase demand by increase in supply and this result in the development of inflationary pressure in the economy. It is, however, a steady rise in the rate of capital formation in the long run that augments the supply of goods, controls inflation and brings stability in the economy. It helps in meeting all the requirements of an increasing population in a developing economy. When capital formation leads to the proper exploitation of natural resources and the establishment of different types of industries, levels of income increase and the varied wants of the people are satisfied. They consume a variety of commodities; their standard of living rises and their economic welfare increases where an increase in economic welfare ceteris paribus is an indication of economic development. Okonkwo (2010) gave credence to this finding when he studied the impact of capital formation on economic growth in Nigeria from 1979-2008 employing the use of the classical linear regression model (CLRM) through the ordinary least square (OLS) method, the impact of capital formation on the Nigeria's economic growth was examined. The result showed that capital formation, government deficit, money supply is positively related to RGDP.

4.5.7 Effect of Bank Credit to the Manufacturing Sector on Average Manufacturing Capacity Utilization in Nigeria.

Bank Credit to Manufacturing Sector (lnBCRMS) was found to have a positive relationship with AMCUR in the current year and also statistically significant at 5% level of significance indicating a strong positive influence on average manufacturing capacity utilization and positively supported AMCUR in the long

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run. If interest rate is high, manufacturing industries shy away from getting bank credits to buy and replace wore out equipment and machines which in turn, undermines their productive capabilities. Kalu et al., (2017) supported this finding when they examined the relative impact of Bank credit on the manufacturing sector in Nigeria from 1986 to 2013 using Autoregressive Distributed Lag (ARDL). They found that volume of bank credit, credit to private sector and exchange rate all exert long-run positive and significant effect on the output of manufacturing sector at 5% level of significance.

5. CONCLUSION AND RECOMMENDATIONS

This study used the Auto Regressive Distributive Lag model to investigate the determinants of capacity utilization in Nigeria's manufacturing sector for the period 1981-2019. From our findings, Electricity Power Consumption Per Capita (ELPCP), Goods Importation (lnGSIMP), Gross Fixed Capital Formation (lnGFCF), Bank Credit to Manufacturing Sector (lnBCRMS) and Lending Interest Rate (LINTR) are strong determinants of Average Manufacturing Capacity Utilization (AMCUR) in Nigeria implying that they contribute and influences capacity utilization in manufacturing industries more than the total labour force (lnTLABF) and inflation rate (CPIND).

The study concludes that while Electricity Power Consumption (ELPCP), Goods Importation (lnGSIMP), Gross Fixed Capital Formation (lnGFCF), Bank Credits to Manufacturing Sector (lnBCRMS) and Lending Interest Rate (LINTR) sttod out as strong determinants of capacity utilization of the manufacturing industries, other determinants such as Total Labour Force (lnTLABF) and Consumer Price Index (CPIND) were noted to be minor determinants of capacity utilization of the manufacturing sector in Nigeria, amidst other internal and external macro-economic shocks.

Nevertheless, to achieve a high and sustainable growth, following policy recommendations have been made.

1. Adequate and stable electricity supply must be a policy focus if the desired output of the manufacturing sector is to be achieved. This will not only spur the manufacturing sector but create employments and reduce poverty.

2. The government and the monetary authorities should encourage manufacturing sector production by making credits available to manufacturers at a competitive price which can be in the form of concessions and establishing a special credit window for this preferred sector of Nigerian economy.

3. This specific study suggests that a well-developed human capital and components of manufacturing sector (e.g., labor force, credit, energy consumption, and taxes on GDP) are essential for further improvement in manufacturing sector growth of a country because increase in employment of labor force can reduce production cost.

4. Efforts should be made to ensure that lending interest rate to the real sector of the economy is kept at affordable level that would encourage investment and avail the

manufacturing industries a level playing ground in engaging in more productive activities.

5. The government should adopt a perfect mix of both the import substitution strategy and export promotion strategy of industrialization. By adopting the import substitution strategy, Nigeria should only import those items which they cannot produce in the meantime and by the export promotion strategy, they should try to ensure that products produced in Nigeria meets up with international standard as this will go a long way motivating the local producers to produce more durable and strong products.

6. Government investment is to be encouraged which forms the capital formation and accumulation. More initiatives outside providing infrastructures and paying salaries should be welcomed. Furthermore, the government should ensure that funds directed for a particular purpose be strictly followed.

7. The government through the Central Bank of Nigeria should pursue policies that lower interest rate (cost of capital) and reduce inflation on one hand and increase money supply as well as loans and advances to the investors in order to increase the output of the manufacturing sector which is capable of stimulating economic growth.

It is the belief of this study that when rhese recommendations are properly implemented, it will go a lonf way to stimulate greater growth of output for manufacturing industries.

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