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Modelling the Determinants of Output in the Nigerian Manufacturing Sector

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ABSTRACT
For any economy aiming for sustainable growth and development, the manufacturing sector is vital. This study analyzed the determinants of output in the Nigerian manufacturing sector from 1986 – 2014. Gross Capital Formation, Bank Credit to Manufacturing Sector, Lending Rate, Employed labour Force, Foreign Direct Investment, Manufacturing Capacity Utilisation Rate, and Foreign Exchange Rate were used as explanatory variables and were regressed on manufacturing sector output (dependent variable). The Unit root test using the Augmented Dickey Fuller test was conducted to test for stationarity among variables. The Johansen Co-integration test was also employed to test for long run equilibrium relationship among the variables; the Granger Causality test was conducted so as to ascertain the causal relationship between variables while the stability test was also conducted to check for the long run stability of the variables employed. The paper found a significant relationship between the explanatory variables employed and the output of the manufacturing sector in Nigeria during the period studied. It was recommended based on findings that there is a need for infrastructural development, importation of goods should be discontinued, consumption of local goods encouraged, agricultural production encouraged as a source of raw material for the industries and low lending rate to the manufacturing sector should be implemented.
Keywords: Manufacturing Sector, Output, Stationarity, Cointegration, Ordinary Least Squares.

INTRODUCTION

Investigations and analysis by scholars have shown that higher productivity and output is a sure means of boosting economic growth and raising standard of living in any country and that the main instruments of rapid growth, structural changes and self sufficiency lies in the manufacturing sector.

The need to give the manufacturing sector great attention is important if the economy is to complete developmentally as a strong and thriving manufacturing sector usually precipitates industrialisation (Emerenini & Ajudua 2015). Todaro & Smith (2011) posited that industrialisation is the process of increasing a society's capability to process raw materials and produce goods for consumption and/or further production given its skills and efficiency.

It has been observed that for an economy to grow, the industrial sector and in particular, the manufacturing sub-sector must be the key driver of the economy. Therefore, incompetent or poor industrial development policies have been recognized as major factors that adversely affect the well being and socio-economic improvement of the people in developing countries and such policies are the major contributing factors to low value added and low economic growth (Anyanwu, 1993).

The manufacturing sector is thus widely considered to be the ideal industry to drive development in Africa as it offers prospects of a growing availability of manufactured products, increased employment, greater efficiency and improved balance of payments which will stimulate and promote productivity, improve living condition and serves as a catalyst for economic growth (Dauda

2006).The achievement of economic development goals depends on the amount of investments made towards the manufacturing sector (Job 2002).

Prior to attainment of independence, the Nigerian economy was mainly agrarian both in production for domestic consumption and exports. Industrialisation was not part of the major policy of the colonial administration. The new government were thus tasked with the transformation of the economy into an industrial one (Ukaegbu, 1991). The manufacturing sector became of paramount importance and believing that the rapid expansion of the sector would be achieved through promotion of SMEs, established the first industrial development centre at Owerri in 1963 which was followed by another at Zaria in 1967. To reverse the continuous trend of the dominance of foreign capital, the Nigerian Enterprises Promotion Decree (NEPD) of 1972 was promulgated to enable Nigerians take equity shares in foreign owned business enterprises. However this proffered little solution due to the foreign exchange problems encountered by the country following the oil glut of the early 1980s and the continuous dependence on foreign materials and poor returns on policies already implemented.

Udabah (1999) posited that the Nigerian economy is dominated by small and medium scale manufacturing industries and are financed mainly by owners. The sector is dominated by low wages, low technology, production of light consumer goods and labour intensive. Available evidence has shown that the sector has not fared well. The sector in the 1960s and 1970s was one of the fast growing sectors in Nigeria. Its average annual growth rate between 1962 and 1973 was 12% and the capacity utilisation rate was as high as 76.6 and 73.3 in 1975 and 1983 respectively (Emerenini & Ajudua, 2015). Its capacity utilisation rate fell from 70.1 to 38.8 between 1980 and 1986 and to 52.3 in 2012 (CBN 2012). MVA per Capita was put at below $100 which was low in comparison to Mauritius, South Africa and Namibia with MVA per Capita rates of $1000, $900 and $500. MVA per GDP for Nigeria was about 3% while Mauritius, South Africa and Namibia had about 16%, 15% and 12% respectively (Emerenini & Ajudua, 2015).

The Nigeria manufacturing sector contribution to GDP have been in one figure not climbing above 10% since 1980 except in 1982 when its contribution was 11.21%. Its contribution to GDP in 2012 was 4.16% and stands at 6.8% in July 2014 (Business Day 2014). The sector is highly import dependent, inward production oriented (establishing solely domestic goods for domestic markets) and has low degree of usage of the rich local raw materials.

Owing to these problems bedevilling the sector, the study thus set out to investigate the variables determining the performance of the output of the manufacturing sector in Nigeria. And would be guide by the hypothesis;

Ho: There is no significant relationship between manufacturing sector output and selected determining variables in Nigeria.

2.0 THEORETICAL FRAMEWORK

The importance of the determinants of output of the manufacturing sector especially in underdeveloped and developing countries is hinged on the theoretical underpinnings below as posited by scholars trying to show the importance of growth in the output of the sector.

2.1 Theory of Unbalanced Growth

The theory of unbalanced growth as posited by Prof A. O. Hirschman stressed on the need of investment in strategic sectors of the economy instead of all the sectors simultaneously as these major sector would serve as a propeller of growth for other sectors for rapid development and the accruement from these sectors utilized for development of other sectors. Other sectors would automatically develop themselves through what is called "linkage effect" (Wulwick, 1992). Hirschman posited that underdeveloped countries are characterised by low per capita income, income inequality, poverty, low productivity, high dependence on agriculture, high rate of consumption, low savings rate, high unemployment etc, hence less and scarce resource to direct towards many sectors. The real scarcity however stems from the ability to bring resources into play, thus Hirschman posited a big push (investment) in strategic selected industries or sectors of the economy and contends that deliberate unbalancing of the economy is the best method of development as development transcends from the major sectors of the economy to the minor, from one industry to another; from one firm to another etc.

Thus, if the economy is to be kept moving ahead, the maintenance of existing imbalances such as tension, disproportions and disequilibrium should be the goal as they can be seen from the angle of profit and losses. Hirschman further divides the initial investment into two related activities; directly productive activities and social overhead capital. The theory holds that an economy should chose to invest in one of these two fields. If an economy invests in Social infrastructure (e.g. roads, water sanitation, transport, banking), it is left for the people to utilize this infrastructure and push towards a growth in directly productive activities (e.g. mining, agriculture, manufacturing). Also, if an economy invests in directly productive activities, people eventually earn enough to work on building their own infrastructure. Whichever the type of investments, it will yield an 'extra dividend' of induced decisions resulting in additional investment and output. However, social overhead capital, and directly productive activities cannot be expanded simultaneously because of the limited ability to utilize resources. Going by this, if there is an improvement in power generation to the manufacturing firms, its induces acceleration in production and by so doing, the capacity utilization rate is improved, leading to an increase in output of the sector which further entails, higher investment and savings, product varieties etc.

2.1.1 Lewis's Theory of Unlimited Supplies of Labour

Propounded by Prof Arthur Lewis in 1954, the theory posits that underdeveloped countries are characterized by overpopulated labour at subsistence wage, and as such development can take place when such excess labour is withdrawn from the agricultural dominant sector to the industrial sector while maintaining a zero marginal labour as no output would be lost in such transfer (Jhingan, 2013). This can lead to creation of new industries or expansion of existing ones.

The theory assumes that the economy runs as a dual economy characterised by traditional and industrial sector, and the unlimited supply of labour in the underdeveloped countries arises due to high population, unemployment/underemployment, high birth rate etc. Lewis posited that the wages in industrial sector remain constant. Consequently, the capitalists will earn surplus. Such surplus will be re-invested in the modern sector which helps to absorb the labour which migrated from traditional sector. However, the speed with which this expansion occurs is determined by the rate of industrial investment and capital accumulation in the modern sector. This process of modern self sustaining growth and employment expansion will continue till all the surplus rural labour is absorbed in the new industrial sector. Thereafter, additional workers can be withdrawn from agricultural sector only at a higher cost of lost food production because this will decrease the labour to land ratios. In this way, the MPL will be no more zero. Thus labour supply curve will become positively sloped along with the growth of modern sector (Jhingan, 2013). Therefore structural transformation of the economy will take place through shifting from traditional rural agriculture to modern urban industry.

2.1.2 Kaldor's Model of Economic Growth

Kaldor postulated a growth model, in which he tried to provide a framework for relating the genesis of technical progress to capital accumulation. Kaldor analysed and posited that development hinges on four fundamental concepts; increasing returns in the manufacturing sector; effective demand-constrained growth; the agriculture-industry relationship and internal-external market relations (Targetti, 1992). Kaldor believed that economic development requires industrialization which is presupposed by agriculture revolution and accompanied by export-led growth policies.

He held that the manufacturing sector is the engine of growth and the more the outputs of the manufacturing sector; the greater is the productivity in the system as a whole. This relies on several factors, firstly, the growth of manufacturing provides capital goods and technical advances embodied in them as input for other sectors; secondly, an increase in output and employment in the manufacturing sector reduces the employment in agriculture but not its output; thirdly greater activity in the manufacturing sector produces greater turnover per worker in the distribution sector (Targetti & Foti, 1997). He posited that technical progress depends on the rate of capital accumulation (Jhingan, 2013). Kaldor postulated that investment at any period depends partly on change in output and partly on the change in profit on capital in the previous period. The model introduced the technical progress function in place of the usual production function.

Owing to the openness of economies, the exchange rate theory becomes an important theoretical underpinning. Exchange rate is the rate at which one currency is traded for another with the foreign exchange market being the markets where such trades are done (Bannock, 1997). Having two forms;

the nominal effective exchange rate (NEER) and real effective exchange rate (REER), the NEER represents the relative value of a home country's currency compared to the other major currencies being traded, representing the approximate relative price a consumer will pay for an imported good, with the REER being used to determine a country's currency value relative to the other major currencies in the index, as adjusted for the effects of inflation which represents the value an individual will pay for an imported good at the consumer level including tariffs and transactions costs associated with importing the good.

The constant movements of exchange rate have implication on the economy. While an appreciation of currency of a country makes importation cheap and increases and foreign reserve, depreciation of currency makes import costly and export cheaper, foreign exchange reserve may be required to stabilize this currency thus resulting in the fall of the reserve. More so, for a country like Nigeria that relies heavily on foreign input for the working of her manufacturing sector, procurement of such inputs becomes burdensome as more units of domestic currency would be required to get the needed inputs in the international market.

2.2 Empirical Framework

Afaha and Ologundudu (2014) investigated the relationship between manufacturing production and determinants of productivity for optimal performance in the industrial sector and found that while liberalization of the Nigerian economy has promoted manufacturing growth, interest rate spread and exchange rates had negative impact on the growth of manufacturing sub-sector in Nigeria during the year of their study. They also found that the rise in the manufacturing sub-sector is a reflection of high inflation rate and cannot be interpreted to mean a real growth in the sector.

Kim and Lau (1994) in their study comparatively analysed the manufacturing sector as the source of economic growth between the Asia Tigers (Hong Kong, Korea, Singapore and Taiwan) and Germany, France, USA, UK and Japan. They concluded that capital accumulation accounted for between 48 to 72% of the growth.

Ukoha (2000) analyzed the determinants of capacity utilization in the Nigerian manufacturing industry between 1970 and 1998. He concluded that the exchange rate, capital expenditure on manufacturing and per capita real income has positive effects on manufacturing capacity utilization while inflation and loans and advances to manufacturing were found to have negative effect.

Bamikole (2012) studied the impact of capacity utilisation on manufacturing productivity growth in Nigeria using cointegration analysis for the period 1975 to 2007. He found out that a negative long run relationship exists between manufacturing productivity and capacity utilisation.

Odior (2013) analysed macroeconomic variables and the productivity of the manufacturing sector in Nigeria and revealed that credit to manufacturing sector and foreign direct investment are important factors determining manufacturing production while consumer price index, exchange rate and interest rate have negative effect on manufacturing output.

3. METHOD OF STUDY

In addition to the descriptive approach in the sections above, the study now adopts an econometric approach so as to understand what actually determines output in the Nigerian manufacturing sector. The data used in this study are basically secondary data collected mainly from the Central Bank of Nigeria's statistical bulletin. The period of study covers between 1986 and 2014.

3.1 Model Specification

In line with the theoretical framework, a single model is specified thus

MSO = f(GCF, BCM, INT, ELF, FDI, CUR, FEX)…….(1)

Econometrically, equation 1 is transformed into an econometric log linear form thus:

$$\ln MSO = X_0 + X_1 \ln GCF + X_2 \ln BCM + X_3 \ln INT + X_4 \ln ELF + X_5 \ln FDI + X_6 \ln CUR + X_7 FEX + \mu \quad ...(2)$$

Where

MSO = Manufacturing Sector Output

GCF = Gross Capital Formation

BCM = Bank Credit to Manufacturing Sector
INT = Lending Rate
ELF = Employed labour Force
FDI = Foreign Direct Investment
CUR = Manufacturing Capacity Utilisation Rate
FEX = Foreign Exchange Rate
X_0 = Intercept
X_1 to X_7 = Coefficients

The a priori expectations for the coefficients are as follows:
$X_0 > 0$; X_1, X_2, X_4, X_5, X_6, > 0; X_3 and $X_7 < 0$
Also, it has been observed that variables exhibit trends of non-stationarity. The unit root test using the Augmented Dickey Fuller test was employed in order to check this problem. Co-integration test was also carried out so as to confirm if the series indeed have long run relationship and the Error Correction Mechanism technique was employed to check for the short run estimate and also derive parsimonious models used for further analysis while the stability test was also employed to check for stability of the variables.

4. ANALYSIS OF RESULTS

4.1 Unit Root Test

Table 1. Unit root test

Variables	ADF Test Statistic	5% Critical Value	Prob	Order of Integration
lnMSO	-3.740186	-2.9798	0.016070	I(1)
lnGCF	-3.657023	-3.5943	0.000260	I(1)
INT	-5.248418	-2.9798	0.000000	I(1)
lnBCM	-3.654945	-2.9798	0.001558	I(1)
lnELF	-4.237551	-2.9798	0.000088	I(1)
lnFDI	-4.884067	-2.9798	0.000001	I(1)
CUR	-2.986903	-2.9798	0.004031	I(1)
FEX	-3.415724	-2.9798	0.000319	I(1)

The unit root test results shown above revealed that all incorporated variables, lnMSO, LnGCF, INT, lnBCM, lnELF, lnFDI, CUR and FEX reject the null hypothesis at first difference. This implies that those time series variables are not stationary at level but at first difference indicating that these series are non-mean reverting, converges towards its long-run equilibrium and their variances are constant overtime.

4.2. Co-integration Test

In order to ascertain if there was a long term relationship existing among these variables, a co-integration test was carried out using the Johansen cointegration test.

Table 2. Co-integration test

Eigenvalue	Likelihood Ratio	5 Percent Critical Value	1 Percent Critical Value	Hypothesized No. of CE(s)
0.973208	350.1420	156.00	168.36	None **
0.955249	252.4119	124.24	133.57	At most 1 **
0.890623	168.5326	94.15	103.18	At most 2 **
0.760405	108.7829	68.52	76.07	At most 3 **
0.751336	70.20513	47.21	54.46	At most 4 **
0.504166	32.63051	29.68	35.65	At most 5 *
0.329782	13.68965	15.41	20.04	At most 6
0.101359	2.885527	3.76	6.65	At most 7

Table 2 shows that the hypothesis of no cointegration among the variables can be rejected as about six cointegrating equation was seen as their likelihood ratio was greater than the 5% critical value. We therefore conclude that there exists a long run equilibrium relationship among variables employed in the study.

4.3 Granger Causality Test

Causality defines the relationship existing between two variables in a model. The test is useful when we know that two variables are related but do not know which variable causes the other to change. The approach to the question to whether X causes Y is to determine how much of the current Y can be explained by past values of Y and then see whether adding lagged values of X can improve the explanation. Y is said to be granger caused by X if X helps in the prediction of Y, or if the coefficient of the lagged Xs are statistically significant. In the case of t-statistic, if the value of the X coefficient is significant but that of Y is not, then X causes Y and we say that there exists a unidirectional causality. However if the value of Y coefficient is statistically significant and that of X is not, then Y causes X which is still a unidirectional causality. In the case where both are significant, then there is bidirectional causality, a in the case where none is significant, there is no causality.

The result revealed no bidirectional relationship among the variables, rather unidirectional causal relationship exist running from lnMSO to lnGCF, lnELF to lnMSO, CUR to lnMSO, FEX to lnMSO, lnGCF to INT, lnGCF to lnELF, lnFDI to lnBCM and INT to lnELF (See Appendix).

4.4 Model Estimation

In estimating the model, ordinary least square method was used to identify the nature of relationship that existed between MSO and other variables using yearly data extracted from the statistical bulletin of Central Bank of Nigeria.

Table 3. Model estimation

Variable	Coefficient	Std. Error	T-Statistic	Prob.
C	-3.124586	7.970425	-0.392022	0.6990
lnGCF	0.223312	0.038398	5.815667	0.0000
lnBCM	-0.260530	0.041328	-6.303900	0.0000
INT	0.004680	0.006090	0.768408	0.4508
lnELF	0.737586	0.460890	3.600354	0.0245
lnFDI	-0.004339	0.020291	-0.213848	0.8327
CUR	-0.004312	0.004091	-1.053936	0.3039
FEX	-0.005834	0.001761	-3.313443	0.0033
R-squared	0.953290	Durbin-Watson stat	1.393344	
Adjusted R-squared	0.937719			
F-statistic	61.22546	Prob(F-statistic)	0.000000	

The estimated model equation from table 3 is given as:

lnMSO = -3.1246 + 0.22lnGCF – 0.26lnBCM + 0.0047INT + 0.74lnELF – 0.0043lnFDI – 0.0043CUR – 0.0058FEX

The interpretation of the model based on the selected economic variables as shown in table above, the R^2 of 0.953290 indicates about 95% of total variation in the dependent variable can be explained by the explanatory variables. The adjusted R^2 of 0.937719 or 93.7%, showed that the explanatory variables were robust in explaining the variation in manufacturing sector output within the period.

The Durbin-Watson statistic of 1.393344 which is less than 2.0 indicates the presence of serial autocorrelation. Nonetheless, the F-statistic has a value of 61.22546 with probability value of 0.000000, which means, it is statistically significant at 5% and the model is a good fit. Therefore, the explanatory variables have a joint significant effect in determining the movement of manufacturing output in Nigeria within the period of study.

In addition, the estimated coefficient of capital formation (0.223312) showed the right positive sign and is statistically significant. This means that a 1% increase in expected capital formation will lead to rise in manufacturing output by 0.22%.

The coefficient of bank credit to manufacturing (-0.260530) did not show the expected positive sign. The coefficient shows a negative sign though statistically significant. A 1% increase in bank credit to manufacturing will reduce output by 0.26%.

The estimated coefficient of employed labour force (0.737586) is rightly signed and statistically significant. This by implication means that a 1% increase in labour force will increase manufacturing output by 0.74%.

The foreign exchange rate coefficient (-0.005834) is rightly signed. It is negative and statistically significant showing that a 1% increase in foreign exchange rate reduces manufacturing output by 0.0058%.

The coefficient of CUR appeared with the expected sign but was not statistically significant while the coefficients of the variables INT and FDI were not rightly signed and were not statistically significant. This means that independently as a variable no relationship existed between the variables and manufacturing output within the stated period.

4.4 Test of Stability

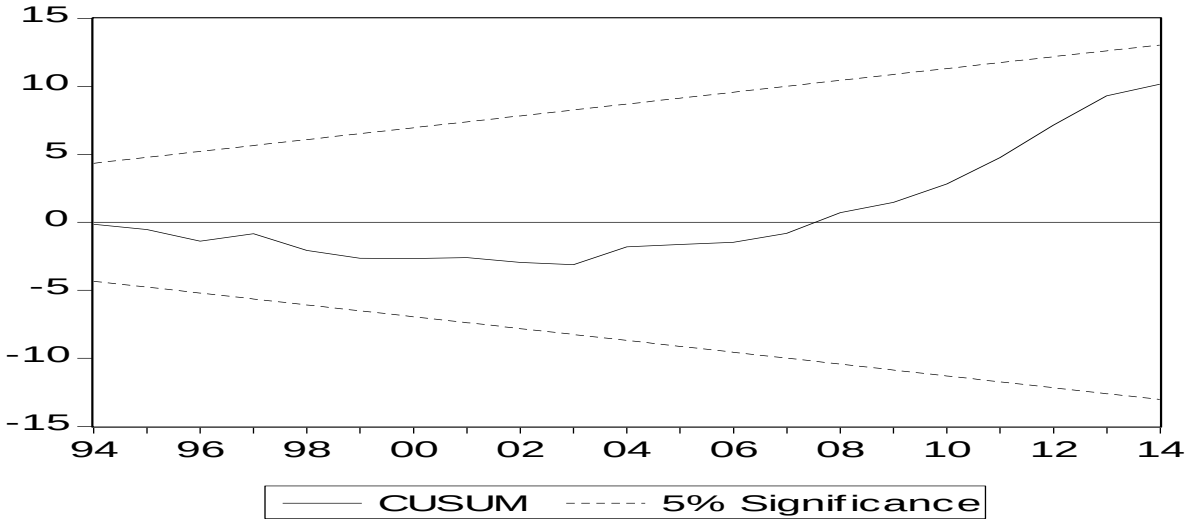


Figure 1: Plot of Cumulative Sum of Recursive Residuals

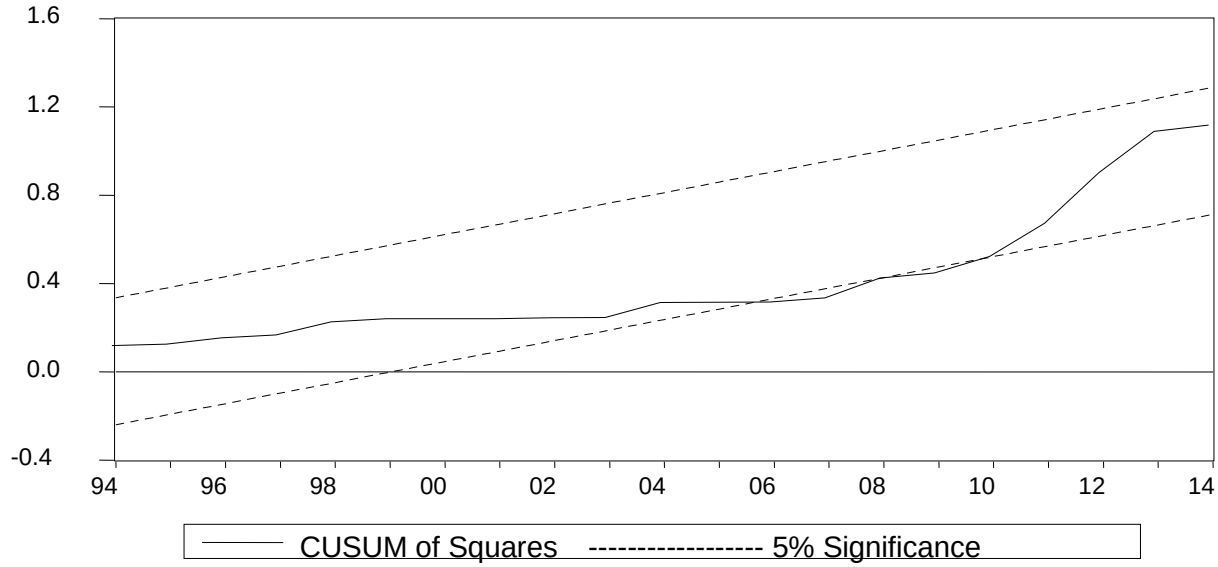


Figure 2: Plot of Cumulative Sum of Squares of Recursive Residuals

The stability test enables us to predict the dependent variables in a regression with a reasonable level of precision given the explanatory variables used in the analysis. Therefore, we conduct the stability test using the method of the two band recursive residuals. This method shows a plot of recursive residuals about the zero line as well as the plus and minus two standard errors is shown at each stage. Also the residuals outside the standard error bands reveal instability in the parameters used in the equations.

The test of stability in figures 1 and 2 above showed that while the CUSUM corroborate the stability view with the plot falling within the 5 percent critical acceptance lines, the CUSUM of Squares plots fell within the critical line but slightly fell out between 2006 to 2008 and also in 2009. Though there was a slight falling out from the critical line, one can generally conclude that the estimated parameters for the study are stable and are useful for policy decision.

CONCLUSION

The aim of the study was to ascertain the determinants of output in the manufacturing sector in the Nigeria economy. The study revealed that the explanatory variables; capital formation, employed labour force, foreign exchange rate and capacity utilization rate conform to a priori expectation while bank credit to manufacturing, interest rate and foreign direct investment do not conform to expectations.

Bank credit to manufacturing appeared with a negative sign corroborating the work of Ukoha (2000). The negative relationship was due to the high cost and difficulties associated with loans and advances from banks for manufacturing projects. Due to the long gestation period of manufacturing projects, such bank credits accumulate huge servicing costs which tend to affect output in the long run. Also, capacity utilization rate was rightly signed but not significant. This is as a result of the fall in capacity utilization rate in Nigeria to about 51% today from about 76% in the early 1970s, occasion by the problems facing the sector such as low and frequently interrupted power supply, low and expensive loans and advances, low infrastructural facilities etc. interest rate was also not significant and stems from the high lending rate in the country which discourages borrowers. Foreign direct investment was not rightly signed and was insignificant. This may stem from the fact that the level of FDI attracted is mediocre compared to the resource base and potential need. Also, FDI has hindered total freedom and economic growth of the host nation. it is linked to the perpetual dependence on developed countries by poor countries; local industries are outcompeted, their productive activities in most cases depend on imported raw material thus the multiplier effect is lower than desired and it also implies increased income remittance abroad leading to capital flight and investors tend to locate high productivity industries and therefore could force less productive firms to exit thus leading to crowding out of domestic firms and possible contraction in total industry size and/or employment.

Based on our findings, the following recommendations are made;

- There is need for a thorough development of the infrastructural base of the country so as to create an enabling environment which will boost the capacity of the manufacturing sector
- Foreign investors should be pushed toward the manufacturing sector and a stringent measure to check their activities should be put in place
- Importation of goods that can be locally manufactured should be discontinued and the consumption and demand for local goods must be encouraged and promoted in the country as this will also check the high cost associated with importation of inputs needed by the sector.
- Agricultural production must be shored up to become the primary and major source of raw material for the industries.
- Friendly lending rate should be implemented while loans and advances to the manufacturing sector should be based on the gestation period of the manufacturing project in hand.

Appendix

Long run Estimates

Dependent Variable: LNMSO
Method: Least Squares
Date: 02/09/16 Time: 12:26
Sample: 1986 2014
Included observations: 29

Variable	Coefficient	Std. Error	t-Statistic	Prob.
C	-3.124586	7.970425	-0.392022	0.6990
LNGCF	0.223312	0.038398	5.815667	0.0000
LNBCM	-0.260530	0.041328	-6.303900	0.0000
INT	0.004680	0.006090	0.768408	0.4508
LNELF	0.737586	0.460890	1.600354	0.1245
LNFDI	-0.004339	0.020291	-0.213848	0.8327
CUR	0.004312	0.004091	1.053936	0.3039
FEX	0.005834	0.001761	3.313443	0.0033

R-squared	0.953290	Mean dependent var	9.840789
Adjusted R-squared	0.937719	S.D. dependent var	0.398516
S.E. of regression	0.099454	Akaike info criterion	-1.549291
Sum squared resid	0.207713	Schwarz criterion	-1.172106
Log likelihood	30.46472	F-statistic	61.22546
Durbin-Watson stat	1.393344	Prob(F-statistic)	0.000000

Cointegration Test
Sample: 1986 2014
Test assumption: Linear deterministic trend in the data
Series: LNMSO LNGCF LNBCM INT LNELF LNFDI CUR FEX
Lags interval: 1 to 1

Eigenvalue	Likelihood Ratio	5 Percent Critical Value	1 Percent Critical Value	Hypothesized No. of CE(s)
0.973208	350.1420	156.00	168.36	None **
0.955249	252.4119	124.24	133.57	At most 1 **
0.890623	168.5326	94.15	103.18	At most 2 **
0.760405	108.7829	68.52	76.07	At most 3 **
0.751336	70.20513	47.21	54.46	At most 4 **
0.504166	32.63051	29.68	35.65	At most 5 *
0.329782	13.68965	15.41	20.04	At most 6
0.101359	2.885527	3.76	6.65	At most 7

*(**) denotes rejection of the hypothesis at 5%(1%) significance level
L.R. test indicates 6 cointegrating equation(s) at 5% significance level

Granger Causality Test
Pairwise Granger Causality Tests
Sample: 1986 2014
Lags: 2

Null Hypothesis:	Obs	F-Statistic	Probability
LNGCF does not Granger Cause LNMSO	27	1.32765	0.28552
LNMSO does not Granger Cause LNGCF		3.77407	0.03898
LNBCM does not Granger Cause LNMSO	27	1.87647	0.17683
LNMSO does not Granger Cause LNBCM		2.58246	0.09830
INT does not Granger Cause LNMSO	27	0.94932	0.40229

LNMSO does not Granger Cause INT		3.40982	0.05129
LNELF does not Granger Cause LNMSO	27	9.94415	0.00084
LNMSO does not Granger Cause LNELF		0.12923	0.87944
LNFDI does not Granger Cause LNMSO	27	0.09236	0.91213
LNMSO does not Granger Cause LNFDI		0.88054	0.42867
CUR does not Granger Cause LNMSO	27	4.12471	0.03011
LNMSO does not Granger Cause CUR		0.78310	0.46932
FEX does not Granger Cause LNMSO	27	3.54821	0.04618
LNMSO does not Granger Cause FEX		1.44999	0.25613
LNBCM does not Granger Cause LNGCF	27	1.73657	0.19941
LNGCF does not Granger Cause LNBCM		2.02659	0.15566
INT does not Granger Cause LNGCF	27	1.13167	0.34056
LNGCF does not Granger Cause INT		4.64549	0.02075
LNELF does not Granger Cause LNGCF	27	0.55225	0.58343
LNGCF does not Granger Cause LNELF		3.72757	0.04035
LNFDI does not Granger Cause LNGCF	27	0.03213	0.96843
LNGCF does not Granger Cause LNFDI		1.71442	0.20326
CUR does not Granger Cause LNGCF	27	2.03521	0.15453
LNGCF does not Granger Cause CUR		0.73478	0.49101
FEX does not Granger Cause LNGCF	27	1.30505	0.29134
LNGCF does not Granger Cause FEX		1.58502	0.22747
LNINT does not Granger Cause LNBCM	27	0.06083	0.94114
LNBCM does not Granger Cause LNINT		2.90041	0.07621
LNELF does not Granger Cause LNBCM	27	0.00662	0.99341
LNBCM does not Granger Cause LNELF		1.40377	0.26683
LNFDI does not Granger Cause LNBCM	27	8.67218	0.00167
LNBCM does not Granger Cause LNFDI		0.73904	0.48906
CUR does not Granger Cause LNBCM	27	1.09013	0.35366
LNBCM does not Granger Cause CUR		1.83666	0.18296
FEX does not Granger Cause LNBCM	27	0.70865	0.50321
LNBCM does not Granger Cause FEX		1.96592	0.16386
LNELF does not Granger Cause INT	27	3.18285	0.06108
INT does not Granger Cause LNELF		3.67662	0.04192
LNFDI does not Granger Cause INT	27	2.37730	0.11622
INT does not Granger Cause LNFDI		0.34454	0.71230
CUR does not Granger Cause INT	27	1.78485	0.19128
INT does not Granger Cause CUR		1.35156	0.27950
FEX does not Granger Cause INT	27	2.24359	0.12979
INT does not Granger Cause FEX		1.21685	0.31533
LNFDI does not Granger Cause LNELF	27	1.08368	0.35574
LNELF does not Granger Cause LNFDI		0.99427	0.38602
CUR does not Granger Cause LNELF	27	0.28720	0.75313
LNELF does not Granger Cause CUR		2.41696	0.11249
FEX does not Granger Cause LNELF	27	1.12671	0.34210
LNELF does not Granger Cause FEX		1.29833	0.29310
CUR does not Granger Cause LNFDI	27	0.08053	0.92289
LNFDI does not Granger Cause CUR		0.48509	0.62207
FEX does not Granger Cause LNFDI	27	0.34679	0.71075
LNFDI does not Granger Cause FEX		1.83679	0.18294
FEX does not Granger Cause CUR	27	3.26064	0.05752
CUR does not Granger Cause FEX		1.37782	0.27304

Figure 1: Plot of Cumulative Sum of Recursive Residuals

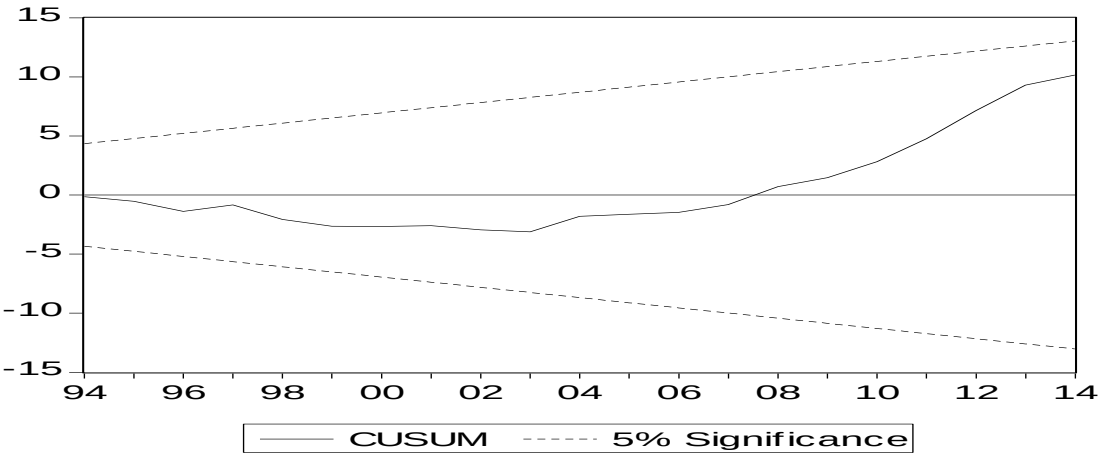
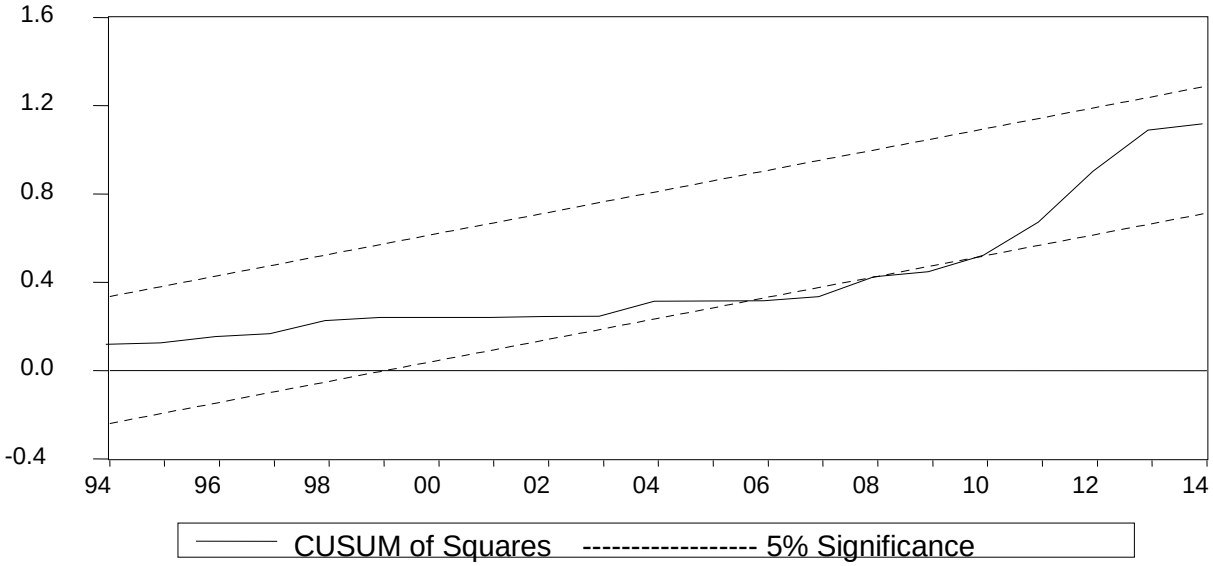


Figure 2: Plot of Cumulative Sum of Squares of Recursive Residuals



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