EFFECT OF MOTOR VEHICLE ASSEMBLY AND FABRICATED METAL PRODUCT ON THE MANUFACTURING CAPACITY UTILIZATION OF NIGERIA ECONOMY (1985-2010)

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ABSTRACT: *The study examined the effect of motor vehicle assembly and fabricated metal product on the manufacturing capacity utilization of Nigeria economy from 1985 to 2010. The study employed data from statistical bulletin of Central Bank of Nigeria (CBN, 2012). The study data comprises of manufacturing capacity utilization (MCU_t) as the dependent variable and, motor vehicle assembly (MVA_t) and fabricated metal product (FMP_t) as the independent variables respectively. The data is analysed using Ordinary Least Square (OLS) multiple regression approach with the aid of statistical software called E-view, version 7. Augmented Dickey-Fuller (ADF) unit root test and Johansen's cointegration method was also employed to check if the variables are stationary or not and if the presence of a long run relationship exist between the variables. The findings revealed that the coefficient of multiple regression accounted for approximately 52.42% in explaining the explanatory variables. This model shows a moderately good fit. The findings also revealed that only FMP_t is statistically significant in explaining the variation in MCU_t at 5% level of significance. The overall test of significance, which is the F-test, indicates that the whole regression is statistically significant due to the overriding effect of FMP_t. The ADF unit test revealed that MCU_t, MVA_t, and FMP_t doesn't have unit root problem at first difference and the variables are stationary at 1%, 5%, and 10% significant level respectively. The Johansen system cointegration test revealed that the trace and max-eigen statistic test shows that the variables are cointegrated and have a long run relationship. The implication of the result is that as more locally fabricated metal product is supply to the economy, it will have a consequential effect on the assembly of motor vehicle parts and the manufacturing capacity utilization rate of the nation due to the relatively exorbitant prices of the supplied product compared with the imported counterparts occasioned by high cost conditions.*
KEYWORDS: Motor Vehicle Assembly; Fabricated Metal Product; Manufacturing Capacity Utilization; Nigeria Economy

INTRODUCTION

The manufacturing sector contributes significantly to any modern economy that have a defined goals and objectives through it diversified unique importance which serves as an indicator to the upgrade of economic growth and development. That is, the manufacturing sector in term of it sensible catalytic role, not only serves as an economic development and growth, but also serves as the strength of most economy. Manufacturing sector in term of it capacity utilization to the economy is the extent to which an enterprise or a nation actually uses its installed productive capacity. It is also the relationship between actual output that is actually produced with the installed equipment, and the potential output which could be produced with it, if capacity was fully used (Wikipedia, 2014). When also view from the engineering perspective, it refers to the estimated output in term of it potential that can be produced in the short run with the available stock of capital.

The Nigerian motor vehicle assembly and fabricated metal product subsector was born with great potentials and resounding expectations. This subsector is literally under fire. It is continually troubled by a lot of factors. One of such is the issue of collapsed capacity utilization which causes the plants to be operating below capacity. This under utilization came as a result of high production cost, shrunken market, stunted growth of the industry and uncontrolled or unchecked competition of new fully built units of metal products and used vehicles.

Nigeria current population and economy makes the country vehicle market potentially attractive one for international manufacturers. Due to poor operation of the capacity plants in recent time, the market share level of the domestic plants shrunk from 66% in 1988 to 30% in 1991, due to decline in the supply of new vehicles of all types in 1982 as a result of adverse economic condition. Other issues that have limited this include lack of patronage both from Nigerians and the government, no reliable supplier network or consumer desire for local products, poor and non conducive operating environment, technical skills and industry know-how to design individual parts or assemble vehicles is lacking, poor capital base, poor performance of local content suppliers, as well as obsolete technology. Another major factor is the lack of political drive by the government of the nation to develop the motor vehicle subsector. In the face of declining local production, local demand has been met almost exclusively through imports. The industry is powerless to compete.

Fabricated Metal Product Manufacturing subsector transform metal into intermediate or end products, or treat metals and metal formed products fabricated elsewhere. The steel industry is an important part of the basic metals sector and integral to the industrialisation landscape of Nigeria. Currently the industry is largely focused on low levels of downstream transformation to basic steel products. Nigeria's basic metals industry is focused on downstream light transformation; mining is still in its infancy, with limited beneficiation and rolling operations underway. Inhibited by infrastructure, low skills, lack of financing and an unfavourable regulatory environment, the sector still offers large potential. A lot of research study had been carried out to investigate how some explanatory variables have an effect on the manufacturing sector. Hence, the objective of this paper is to investigate the effect of motor vehicle assembly and fabricated metal product on the manufacturing capacity utilization of Nigeria economy.

LITERATURE REVIEW

Mojekwu and Iwuji (2012) examined the impact of some macroeconomic variables and power supply on the performance of the Nigerian manufacturing sector using ex-post facto research design. Their findings revealed that power supply had positive and significant impact on capacity utilization while inflation rate and interest rate had negative impact on capacity utilization.

Simon-Oke and Awoyemi (2010) investigated the impact of manufacturing capacity utilization on industrial development in Nigeria by regressing manufacturing capacity utilization, value added and employment generation on index of industrial productivity using cointegration and error correction mechanism as analytical tools. Their econometric findings showed that there is a long run positive relationship between manufacturing capacity utilization, value added and index of industrial productivity in Nigeria.

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Sola *et al*., (2013) examined the manufacturing performance for sustainable economic development in Nigeria using a time series data of Central Bank of Nigeria (CBN) statistical bulletin between 1980 and 2008. Their findings showed that there exist positive relationship between manufacturing and each of capacity utilization and import. Also, their findings showed that there is a negative relationship between manufacturing and each investment, exchange rate, and import.

Ihejirika (2012) examined the relationship between dividend payout policy, capacity utilization and the industrial production index for Nigeria using Autoregressive Distributed Lag (ARDL) model approach which was employed in the cointegration analysis and Error Correction Model (ECM). The findings revealed that ARDL bound tests suggested that the average dividend yield, capacity utilization and the industrial production index series are cointegrated. The ECM also revealed that capacity utilization and the industrial production index have significant causative implications for dividend payout policy. The findings suggested that policies designed to increase the capacity utilization rate should be favourable for the dividend payout policy of firms in Nigeria.

Omobowale (2010) investigated the challenges and opportunities of the local industries involved in the fabrication of agro-related machinery in Nigeria with the aid of primary source of cross-sectional survey information. The findings highlighted the problems facing indigenous industries fabricating agro-allied equipment in Nigeria with a view to national development.
Onuoha (2013) identified the factors militating against the global competitiveness of manufacturing firms in Nigeria. The findings highlighted the major challenges and problems of the sector as deteriorating and poor infrastructures, high production costs, inconsistent government policies on the sector, etc.

Sobanke *et al*., (2012) assessed the technological capacity in the metal fabricating firms in southern Nigeria using a cross-sectional design survey of a design questionnaire which was sampled randomly across the firms. The findings revealed that their exist a variation in the technological capacity index scores of firms which are micro, small and medium in term of their metal fabrication.

RESEARCH METHODOLOGY

The main aim of the study is to analyse and evaluate the effect of motor vehicles assembly and fabricated metal products on the manufacturing capacity utilization of Nigeria using time series data for a period of 26years between 1985 and 2010. The data used in this study is collected from statistical bulletin of Central Bank of Nigeria (CBN), volume 23. For the purpose of this study, Ordinary Least Square (OLS) estimates as a multiple regression model is adopted in this research in order to estimate the model parameters. Augmented Dickey-Fuller (ADF) unit root test and Johansen's cointegration test will also be adopted in this research paper to verify if the data set are stationary or not and if they are cointegrated. The instrument of analysis is reliable in the sense that the effectiveness of the result derived from it can be subjected to the test of accuracy, to know whether the result is spurious or not. The variables will be analysed with the aid of a statistical package called E-view 7.0.

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MODELS SPECIFICATION

The behaviour of the motor vehicles assembly and fabricated metal products to manufacturing capacity utilization of Nigeria economy is of paramount importance to this research. The emphasis lies on the effect of motor vehicles assembly and fabricated metal products on manufacturing capacity utilization of Nigeria economy.

The model for this study is as follows:

$$MCU = f(MVA_t, FMP_t, \mu_t) \qquad 1$$

The functional form of the model could be presented explicitly as:

$$MCU_t = \beta_0 + \beta_1 MVA_t + \beta_2 FMP_t + \mu_t \qquad 2$$

Where:

MCU_t = Manufacturing Capacity Utilization of the time trend
MVA_t = Motor Vehicles Assembly of the time trend
FMP_t = Fabricated Metal Products of the time trend
μ_t = Stochastic random error term
t = Time trend
β_0 is the intercept of the regression line; β_1 &β_2 are the slope of the regression line or behaviour parameters, each representing the unit change in the dependent variable due to a unit change in each regressor.

Unit Root Testing

In order to validate the characteristic in our time series data, we utilize Augmented Dickey-Fuller (ADF) test. This is to ensure accuracy regarding the unit root conclusion. The equation for the ADF is given below:

$$\Delta x_t = \alpha + \pi x_{t-1} + \sum_{i=1}^{p} \gamma_i \Delta x_{t-1} + \epsilon_t \qquad 3$$

To select each model's optimal lag length we maximize the log-likelihood function of the corresponding model. This is done by selecting the model with the lowest Schwartz criterion information.

Johansen's Cointegration Method

The johansen's cointegration used in this research study is to check if the variables are cointegrated and have a long run relationship between them. That is, to determine the number of cointegrating vectors in a non-stationary time series Vector Auto-Regression (VAR). Johansen's estimation model is as follows:

$$\Delta x_t = \mu + \sum_{i=1}^{p} \Gamma_i \Delta x_{t-1} + \alpha\beta' x_{t-1} + \epsilon_t \qquad 4$$

Where:

x_t = (n x 1) vector of all the non-stationary indices in the study
Γ_i = (n x n) matrix of coefficients
α = (n x r) matrix of error correction coefficients where r is the number of cointegrating relationships in the variables, so that $0 < r < n$. This measures the speed at which the variables adjust to their equilibrium
β = (n x r) matrix of r cointegrating vectors, so that $0 < r < n$. This is what represents the long run cointegrating relationship between the variables.

Johansen (1991) defines two different test statistics for cointegration under his method which are Trace test and the Maximum Eigenvalue test respectively. The Trace test is a joint test that tests the null hypothesis of no cointegration against the alternative hypothesis of cointegration. The Maximum Eigenvalue test conducts test in each eigenvalue separately. Their equations are as below:

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$\lambda_{trace}(r) = -T\sum_{i=r+1}^{g} In(1-\hat{\lambda}_i)$ 5

$\lambda_{max}(r, r+1) = -TIn(1-\hat{\lambda}_{r+1})$ 6

r = number of cointegrating vectors under the null

$\hat{\lambda}_i$ = estimated ith ordered eigenvalue from the $\alpha\beta'$ matrices

RESEARCH HYPOTHESES

The following null hypotheses are formulated to guide the scope of the research study:
H01: There is no significant difference between motor vehicle assembly and fabricated metal product on the manufacturing capacity utilization of Nigeria economy.
H02: The variables are not stationary or have a unit root problem.
H03: The variables are not cointegrated.

RESULT AND DISCUSSION

The estimated model of the regression result is stated below:

$MCU_t = 23.03323 - 0.156164MVA_t + 0.565366FMP_t$ 7

$S.E = \quad (5.495643) \quad (0.080440) \quad (0.117095)$

$t_{cal} = \quad (4.191181) \quad (-1.941374) \quad (4.828265)$

$R^2 = 0.524181; Adj. R^2 = 0.480925; DW = 0.799617; F - stat. = 12.11805;$

$Prob(F - statistic) = 0.000283$

The value of standard error and t-statistics are stated in the parenthesis respectively while other parameter estimates are stated below the results.

The Determinant of Multiple Regression(R^2)

The determinant of multiple regression (R^2) stood at approximately 0.5242, which indicates that a change in the manufacturing capacity utilization is explained to the tune of 52.42% by the independent variables (MVA_t, FMP_t) while 47.58% variation remains unexplained. The adjusted R^2 of approximately 48.09% shows that R^2 indicates the true behaviour of the dependent variable (MCU_t) according to change in independent variables.

Test of Significance of the Parameter Estimates

The standard error test and student's t-test were used to establish the significance of the parameter estimates.

Standard Error Test

To determine the significance of the parameter estimate, half of each coefficient is compared with its standard errors. The result of the standard error test is presented below:

Table 1.0: Standard Error Test

Dependent variable	Explanatory variables	Coefficient ($\widehat{b_\iota}$)	Standard error($s\widehat{b_\iota}$)	Implication $1/2\, \hat{b}_\iota > s\hat{b}_\iota$	Decision
MCU_t	Constant	23.03323	5.495643	11.516615>5.495643	Significant
	MVA_t	-0.156164	0.08044	0.078082<0.08044	Not significant
	FMP_t	0.565366	0.117095	0.282683>0.117095	Significant

Source: Author computation

From the table above, it could be observed that our regression estimate is not statistically significant except for fabricated metal product(FMP_t) that is significantly different from zero on variation in MCU_t, at 5% level of significance, using a two-tail test. The implication of the result is that as more locally fabricated metal product is supply to the economy, it will have a consequential effect on the assembly of motor vehicle parts and the manufacturing capacity utilization rate of the nation due to the relatively exorbitant prices of the supplied product compared with the imported counterparts occasioned by high cost conditions.

Student's t-test

The summary of the results of student's t-test of significance of the parameter estimates is presented below:

Table 2.0: Student's t-test

Dependent variable	**Explanatory variable**	t_{cal}	**P-value at 5% sig.level**	**Implication (p<0.05)**	**Decision**
MCU_t	Constant	4.191181	0.0004	0.0004<0.05	Significant
	MVA_t	-1.9413774	0.0651	0.0651>0.05	Not significant
	FMP_t	4.828265	0.0001	0.0001<0.05	Significant

Source: Author Computation

From Table 4.2, only FMPt is statistically significant in explaining the variation in MCUt at 5% level of significance. Motor vehicle assembly (MVA_t) does not play a significant impact on the manufacturing capacity utilization of the Nigeria economy.

The F-distribution Test

Table 3.0: F-distribution test

F_{cal}	**Prob.**	**Implication(p<0.05)**	**Decision**
12.11805	0.000283	0.000283<0.05	H_0 is rejected

Source: Author Computation

From the above table, the p-value of the calculated F-test is lesser than the test of significance (p<0.05). This is a clear indication that the whole regression is statistically significant due to the overriding effect of FMP_t. Hence, the null hypothesis is rejected. We therefore conclude that there is significant difference between motor vehicle assemblies and fabricated metal products on the manufacturing capacity utilization of Nigerian economy.

Durbin-Watson Test of Autocorrelation

Using amended Durbin-Watson test at 5% critical values. The following results were obtained:

N = 26 (Number of observed years)

K = 2 (Number of explanatory variables)

$$d_L = 1.224, d_u = 1.553$$

$$d^* < d_L and\ d_U$$

Hence, the null hypothesis is rejected indicating that there is statistical evidence that the error terms are positively autocorrelated.

Table 4.0: Result of Autocorrelation Test

Durbin-Watson calculated(d*)	**Lower limit of observed Durbin-Watson(d_L)**	**Upper limit of observed Durbin-Watson(d_U)**	$d^* < d_L and\ d_U$	**Decision**
0.799617	1.224	1.553	Yes	Reject H_0

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Source: Author computation

The Durbin-Watson value of 0.799617 indicated the presence of autocorrelation of the first order among the residuals of the model. This implies that any shock arising from the explanatory variables in the utilization rate do not disappear instantaneously but extends into the next periods.

Unit Root Test

Table 5.0: Augmented Dickey-Fuller (ADF) Unit Root Test

	[illegible]	[illegible]	
[illegible]	[illegible]		
[illegible]	[illegible]	[illegible]	
[illegible]	[illegible]	[illegible]	
[illegible]	[illegible]	[illegible]	
[illegible]	[illegible]	[illegible]	[illegible]
[illegible]	[illegible]	[illegible]	[illegible]
[illegible]	[illegible]	[illegible]	[illegible]
[illegible]	[illegible]	[illegible]	[illegible]

Source: Author computation

Note: A variable is stationary when ADF values exceed the critical values

The Table 5.0 shows the Augmented Dicker-Fuller (ADF) unit root test of the variables under review. The absolute value of the Augmented Dicker-Fuller (ADF) unit test at first difference is greater than the critical values at 1%, 5%, and 10% significant level respectively. Therefore we reject the null hypothesis (H_0). This implies that MCU_t, MVA_t, and FMP_t doesn't have unit root problem and the variables are stationary at 1%, 5%, and 10% significant level respectively.

Johansen System Co-integration Test

Johansen's Multivariate Cointegration Test

Table 6(a): Unrestricted Cointegration Rank Test (Trace)

Hypothesized No. of CE(s)	Eigenvalue	Trace Statistic	0.05 Critical Value	Prob.**
None *	0.931087	65.06354	29.79707	0.0000
At most 1 *	0.516250	16.91505	15.49471	0.0304
At most 2 *	0.192278	3.843665	3.841466	0.0499

Trace test indicates 3 cointegrating eqn(s) at the 0.05 level
* denotes rejection of the hypothesis at the 0.05 level
**MacKinnon-Haug-Michelis (1999) p-values

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Table 6(b): Unrestricted Cointegration Rank Test (Maximum Eigenvalue)

Hypothesized No. of CE(s)	Eigenvalue	Max-Eigen Statistic	0.05 Critical Value	Prob.**
None *	0.931087	48.14849	21.13162	0.0000
At most 1	0.516250	13.07138	14.26460	0.0765
At most 2 *	0.192278	3.843665	3.841466	0.0499

Max-eigenvalue test indicates 1 cointegrating eqn(s) at the 0.05 level
* denotes rejection of the hypothesis at the 0.05 level
**MacKinnon-Haug-Michelis (1999) p-values

The Table 6(a) and 6(b) shows the Johansen's Multivariate co-integration test of the variables used in this research study. Based on the hypothesized number of cointegrated equation(s), the trace test indicates three (3) cointegrating equation at 0.05 level, while the max-eigen statistic test indicates one (1) cointegrating equation at 0.05 level. We therefore reject the null hypothesis and conclude that the variables are cointegrated, meaning that the variables (MCU_t, MVA_t, FMP_t) have a unique long run relationship.

$$MCU_t = \underset{(0.03246)}{0.438979}MVA_t - \underset{(0.05389)}{0.264361}FMP_t \quad 8$$

Normalizing variable MCU_t, the short run cointegrated relationship is presented in the above equation; with asymptotic standard errors reported in parentheses. It is clear that growth rate of MCU_t have dominant long run effect on FMP_t than MVA_t. This result seems consistent with the fact that increased MCU_t offers stronger explanation of FMP_t; while MVA_t played a relatively weak role. The long run effects of the variables with the standard error values reported in parentheses are also statistically significant at 5 percent level.

THEORETICAL IMPLICATION OF THE FINDINGS

Motor vehicle assembly has a negative sign coefficient and is statistically not significant to the estimated model. This implies that increase in the motor vehicle assembly rate will decline the capacity utilization rate by an approximate value of 15.62% within the period considered. Also, the fabricated metal product has a positive sign coefficient and is statistically significant to the estimated model. This implies that increase in the rate of fabricated metal product will positively affects the capacity utilization rate by an approximate value of 56.54%. This findings are in agreement with MAN, (2000) that there is lack of a level playing ground for local manufacturing industries to compete with cheap import owing to premature and uncoordinated pursuit of import liberalization, dumping and inconsistency in government policies.

CONCLUSION

The analysis in this research paper shows that the allocated rate for fabricated metal product within the period considered through the manufacturing capacity utilization rate of the economy have a consequential effect on the motor vehicle assembly parts which is caused by relatively exorbitant prices of the supplied fabricated product compared with the imported counterparts occasioned by high cost conditions.

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REFERENCES

Capacity Utilization (2014): en.wikipedia.org/wiki/Capacity_utilization

Ihejirika, P.O., (2012): Capacity Utilization, Industrial Production Index and Dividend Payout Policy in Nigeria: An Autoregressive Distributed Lag (ARDL) Model Approach to Cointegration. Research Journal of Finance and Accounting. Vol. 3, No. 6, pp. 23-34.

Johansen, S. (1991). Estimation and Hypothesis Testing of Cointegrating Vectors in Gaussian Vector Autoregressive Models. Econometrica , Vol. 59, pp. 1551–1580.

Manufacturers Association of Nigeria, MAN., (2000): MAN Half Yearly Economic Review: July to December 1999, MAN Lagos.

Mojekwu, J.N., and Iwuji, I.I., (2012): Factors Affecting Capacity Utilization Decisions in Nigeria: A Time Series Analysis. International Business Research. Published by Canadian Centre of Science and Education. Vol. 5, No.1, pp. 157-163, January.

Omobowale, M.O., (2010): Problems Facing Local Manufacturers in the Nigerian Agro-Allied Machine Fabrication Industry. ATDF Journal. Vol. 7, Issue 3/4, pp. 3-8.

Onuoha, B.C., (2013): Factors Militating Against the Global Competitiveness of Manufacturing Firms in Nigeria. American International Journal of Contemporary Research. Vol. 3, No. 4, pp. 54-63, April.

Simon-Oke, O.O., and Awoyemi, O.V., (2010): Manufacturing Capacity Utilization and Industrial Development in Nigeria: An Assessment (1976-2005). An International Multi-Disciplinary Journal, Ethiopia. Vol. 4, No.2, pp. 265-275, April.

Sobanke, V.O., Ilori, M.O., and Adegbite, S.A., (2012): Technological Capacity in Metal Fabricating Firms in Southwestern Nigeria. American Journal of Industrial and Business management. Vol. 2, pp. 176-183, October.

Sola, O., Obamuyi, T.M., Adekunjo, F.O., and Ogunleye, E.O., (2013): Manufacturing Performance in Nigeria: Implication for Sustainable Development. Asian Economic and Financial Review. Vol. 9, No. 3, pp. 1195-1213.

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