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Assessment of Long Run Relationship between Exchange Rate and Manufacturing Sector's Output: Evidence from Nigeria

Olubunmi Omotayo [α] & Alani Olusegun [σ]

Abstract- The main aim of this research is to examine the relationship between exchange rates and manufacturing output in Nigeria. The research paper made use of secondary data in reaching the objectives of this research work. Data were sourced mainly from Central Bank of Nigeria (CBN) Statistical Bulletin, CBN Statement of Accounts and Annual Reports, and the Nigerian Bureau of Statistics publications. The variables for which data are sourced include: manufacturing output, manufacturing capacity utilization, exchange rate, government expenditure, inflation rates and interest rate for the period 1980 to 2020. The result of the regression estimate showed that Exchange rate and government expenditure on manufacturing sector variables has a positive and significant impact on manufacturing productivity, while consumer price index and manufacturing capacity utility rate variables has a negative and significant impact on manufacturing productivity but interest rate, has negative and insignificant impact on manufacturing productivity during the study period. The study concluded that Exchange rate, government expenditure on manufacturing sector, consumer price index, manufacturing capacity utility, and interest rate influences manufacturing output. In order to boast the level of Manufacturing output in Nigeria, there is the need for the government to manage or control the exchange rate in order stimulate export and support export-led growth, particularly in the provision of incentives and soft loans for export of locally produced manufacturing output.

Keywords: manufacturing output, manufacturing capacity utilization, exchange rate, government expenditure, inflation rates and interest rate.

I. Introduction

In the universe today the manufacturing sector is generally regarded as being capable of accelerating the growth and development process in a country's economy. A major reason for this is as a result of the nature of activities that has taken place in this sector which has brought about significant linkages that has contributed across all other sectors. The Nigerian manufacturing sector is still underdeveloped with very low level of capacity utilization and contribution to aggregate output in spite of the fact that it has been considered as one of the fastest growing sector in Nigeria since 1973 and 1974 (Ojo, 1990; Obadan, 1994). The low level of development in this sector has often been attributed to increasingly dependence on the external sector for import of essential manufacturing inputs (Okigbo, 1993).

The exchange rate which is the price of one currency in terms of another currency which has been a veritable instrument of economic management and therefore it is been regarded as one of the most important macroeconomic indicator used in assessing the overall performance of an economy. Douglas and Jike (2005) noted that movements in exchange rate are known to have ripple effect on other economic variables such as interest rate, inflation rate, unemployment rate, terms of trade, and so on. These factors especially notethe importance of exchange rate to the economic well-being of every country which deals with both domestic and international goods and services.

According to Obaseki (2001) the Central Bank of Nigeria has implemented different techniques in the management of the exchange rate of the naira. Also Obadan (2002) believed that past exchange rate policies have been designed with a bias towards demand management in Nigeria, as the supply side has always been limited by the monoculture base of the economy, where foreign exchange inflow is dominated by oil export proceeds.

a) *Significance of the study*

The unique role of every government is to be able to stabilize her economy by ensuring a favorable balance of the countries exchange rate with other growing economies so as to increase the level of production. The main aim of the study is to find lasting solution to the problems or relationship that exists between the rate of exchange and the growth of manufacturing output in Nigeria. This research study is meant to provide necessary information to researchers, economic stakeholders, financial advisers on the impact of exchange rates on the performance of Nigeria manufacturing sector.

b) *Research questions*

In order to achieve adequate research results, the research question to be answered is "What is the relationship between exchange rate and manufacturing output in Nigeria?"

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c) *The scope of the study*

The study is aimed at examining the relationships between exchange rate and manufacturing output in Nigeria between 1980-2020. The structure of this study is to evaluate the relationships between exchange rate and manufacturing output in Nigeria.

II. Literature Review

a) *Conceptual review*

Exchange rate has been defined as the value or price of a particular currency expressed in terms of some other currency. The word exchange rate has been defined by many scholars in terms of its function or role. Lawal (2016) defined exchange rate as the price at which purchase and sale of foreign currency takes place, which is the amount of one currency that must be paid in order to obtain one unit of another currency. Sanusi (2002) defined the exchange rate as the relative price of two assets in one country in terms of another. The exchange rate plays a critical role in an economy because imports and exports constitute a large part of the economy.

Globally exchange fluctuation is seen as the bed rock to all economic activities across all countries in the world today. Douglas and Jike (2005) noted that fluctuation in exchange rate are known to have ripple effect on other economic variable like interest rate, inflation rate, unemployment rate, terms of trade and many more. In fact all these factors show the importance of exchange rate to economic productivity of every country that deals in international trade. Over time the Nigeria exchange rate has changed from a regulated regime to a deregulated regime. Dada and Oyeranti (2012) agreed that the exchange rate of the naira was relatively stable between 1973 and 1979 during the oil boom era and when agricultural products accounted for more than 70% of the nation's gross domestic products (GDP).

b) *The importance of manufacturing sector to an economy*

Historically, the growth in manufacturing output has been a key element in the successful transformation of most economies that have seen sustained rises in their per capita incomes. In developing and underdeveloped countries, performance in terms of growth and development in this area has been poor over the last decades. The unavailability of high-quality data constitutes a major problem or impediment for relevant research on African industry, and previous economic research on Africa has therefore been based on aggregate data. Opaluwa, Umeh and Abu (2010) opined that the manufacturing sector plays catalytic role in a modern economy and has many dynamic benefits that are crucial for economic transformation.

According to Opaluwa et al. (2010) noted that in an advanced country, the manufacturing sector is a leading sector in many respects; it is an avenue for increasing productivity in relation to import substitution and export expansion, creating foreign exchange earning capacity, raising employment, promoting the growth of investment at a faster rate than any other sector of the economy, as well as wider and more efficient linkage among different sectors.

c) *Theoretical review of literature*

The theoretical framework that will be used during the course of this study is the Modified Mundell–Fleming IS-LM Model that are reviewed in this work, as demonstrated by Jhingan (2011).

- *The Modified Mundell–Fleming is-Lm Model:* also known as the IS-LM-BoP model will be the theoretical base of this study. The model is an extension of the traditional IS-LM Model extended by Jhingan (2011) as a mathematical representation of Keynesian macroeconomic theory. While the traditional LM-SM deals with a closed economy, the Mundell–Fleming model describes an open economy and portrays the short-run and long-run relationship between an economy's nominal exchange rate, interest rate, and output with the assumption that output is demand determined. The demand side of the economy consists of three markets, namely; the goods, money and the foreign exchange market, all of which must simultaneously be in equilibrium for the economy to be in equilibrium.

d) *Empirical review of literature*

According to Lawal (2016) examined the effect of exchange rate fluctuations on manufacturing sector output in Nigeria from 1986 to 2014, a period of 28 years. He made use of secondary data and data on manufacturing output, Consumer Price Index (CPI), Government Capital Expenditure (GCE) and Real Effective Exchange Rate (EXC) were sourced from the CBN statistical bulletin. The data were analyzed using the Autoregressive Distributive Lag (ARDL) technique and the result of the analysis showed that exchange rate fluctuations have a long run relationship with manu facturing sector output. The result showed that exchange rate has a positive but insignificant relationship with manufacturing sector's output.

Ehinohem and Oladipo (2012) researched into the relationship between exchange rate and manufacturing performance in Nigeria between 1986 and 2010. They employed the ordinary least square (OLS) technique and found that exchange rate depreciation has no significant impact on manufacturing output in Nigeria. In their research they found out that in Nigeria, exchange rate appreciation has a significant relationship with domestic output. Also, it was found in

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their research that appreciation of exchange rate has significant impact on manufacturing output. They observed that inflation has positive effect on manufacturing output. They suggested that the Nigerian government should focus on giving subsidy to the manufacturing sector to cushion the negative effect of exchange rate movement on manufacturing.

III. Research Methodology

a) Sources of data

Data were sourced mainly from the publications of the Central Bank of Nigeria (CBN) namely; CBN Statistical Bulletin, CBN Statement of Accounts and Annual Reports, and the Nigerian Bureau of Statistics publications. The variables for which data are sourced include: manufacturing output, manufacturing capacity utilization, exchange rate, government expenditure, inflation rates and interest rate for the period 1980 to 2020.

b) Data analysis technique

The analysis of this study is based on time series data for the Nigerian manufacturing sector, exchange rates and other macroeconomic data. Due to the linearity nature of the model formulation, Ordinary Least Square (OLS) estimation techniques of regression analysis will be adopted in obtaining the numerical estimates of the coefficients in the model using Statistics/data analysis (Eview8) econometric software. A multiple regression model is used in the estimation. The model seeks to investigate the relationship between exchange rate and manufacturing output in Nigeria. The estimation period is restricted to the period from 1980 to 2020.

c) Model specification

The model is to investigate the relationship between exchange rate and manufacturing output in Nigeria. This is stated below with the dependent variable as manufacturing output, while the explanatory variables are: manufacturing capacity utilization, exchange rate, government expenditure on manufacturing sector, inflation rates and interest rate. Thus adopting Nnanna (2001) approach to measuring manufacturing sectoral growth and performance and the model is a modified version of Lawal (2016) and Akinlo(2015).

The model for this study is specified thus;

$$\text{MAN-O} = f(\text{MCU, EXR, GEMS, INT, CPI})$$

Where;
MAN-O = manufacturing output
MCU = manufacturing capacity utilization
EXR = Exchange rate
GEMS = government expenditure on manufacturing sector
INT = interest rate
CPI = consumer price index as a proxy for inflation
The functional form of this model can be written in econometric format thus;

$$\text{MAN-O} = \beta 0 + \beta 1\ \text{MCU} + \beta 2\ \text{EXR} + \beta 3\ \text{GEMS} + \beta 4\ \text{INT} + \beta 5\ \text{CPI} + \mu$$

Where $\beta 0, \beta 1, \beta 2, \beta 3, \beta 4, \beta 5$ are the unknown parameters used in estimating the model
μ is the error of disturbance.

d) Estimation technique

The augmented dickey fuller unit root test was employed to determine the stationarity and other properties of the variables in the model in order to determine the time series characteristics of each variables, followed by the autoregressive distributed lag of co-integration and error correction model was used to analyze the dynamic nature (long run and short run) of the relationship between the dependent variable(manufacturing output) and the independent variables (exchange rate, manufacturing utility capitalization, consumer price index, government expenditure on manufacturing sector and interest rate) and lastly the residual test was conducted to test for the stability reliability of the model.

e) Unit root test

This is used to test the stationarity and this is done using the augmented dickey fuller test (ADF) with the hypothesis which states as follow: if the absolute value of the augmented dickey fuller (ADF) test is greater than the critical value either at 1%, 5%, 10% level of significance then the variables are stationary either at order zero, one or two. The augmented dickey fuller test equation is specified below as follow:

f) Presentation of results and empirical analysis

This chapter presents the result and the interpretations of our analyses. The chapter begins with summary statistics followed by the trend analysis of manufacturing output, exchange rate, government expenditure on manufacturing sector, consumer price index, manufacturing capacity utility rate, and interest rate. Also, statistical properties of variables were examined through Augmented Dickey Fuller test in order to determine the time series characteristics of each variables, followed by autoregressive distributed lags of co integration and error correction model was

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used to analyze the dynamic nature (long run and short run) of the relationship between dependent variable (manufacturing output) and the independent variables (exchange rate, government expenditure on manufacturing sector, consumer price index, manufacturing capacity utility rate, and interest rate) and lastly, residual test was conducted to test for the stability reliability of the model.

Table 1: ARDL Bounds Test

Test Statistic	Value	K
F-statistic	6.725666	5
Critical Value Bounds		
Significance	I0 Bound	I1 Bound
10%	2.08	3
5%	2.39	3.38
2.5%	2.7	3.73
1%	3.06	4.15

Source: Author's computation

Using the ARDL bounds test, the result above shows that with the assumption of weak exogeneity on manufacturing output, exchange rate, government expenditure on manufacturing sector, consumer price index, manufacturing capacity utility rate, and interest rate. The hypothesis of no long run relationship can be rejected at 5% significant levels as the F-statistic for the model is greater than 5% of both I (0) and I (1) bounds of 2.27 and 3.28 respectively. Thus, this shows existence of long-run relationship between manufacturing output, exchange rate, government expenditure on manufacturing sector, consumer price index, manufacturing capacity utility rate, and interest rate.

g) ARDL analysis

This subsection presents the result obtained from estimating the ARDL unrestricted error correction (short run or dynamic) model and the ARDL long-run (static) model in equation. Following this result, this study examines and estimates both short-run dynamics and the long-run relationships between manufacturing output, exchange rate, government expenditure on manufacturing sector, consumer price index, manufacturing capacity utility rate, and interest rate.

Table 2: Long run multiplier coefficient of ARDL

Variables	Coefficient	Std. Error	t-Statistic	Prob.*
INTR	-0.060043	0.073852	-0.813017	0.4473
LOG(GEMS)	6.427274	1.290657	4.979846	0.0025
EXR	0.068764	0.007138	9.632927	0.0001
CPI	-0.326663	0.067977	-4.805461	0.0030
MCUR	-0.717435	0.101174	-7.091117	0.0004
C	-7.027398	5.204740	-1.350192	0.2257

h) Long-Run ARDL Model analysis

It is confirmed from the result that Exchange rate and government expenditure on manufacturing sector variables had positively significant impact on manufacturing productivity, while consumer price index and manufacturing capacity utility rate variables has negative significant impact on manufacturing productivity and interest rate, has negative insignificant impact on manufacturing productivity.

The co integration equation is:

$$MANN = -7.027398 - 0.060043INTR + 6.427274LOG(GEMS) + 0.068764EXR - 0.326663CPI - 0.717435$$

There is need to emphasize here that the result discussed above do not analyze the short-run relationship of the respective variables on manufacturing output. When co integration exists, the Engle-Granger Theorem establishes the encompassing power of the error correction mechanism over other forms of dynamic specifications. The next section reports the results of the Error Correction Mechanism.

Table 3: ARDLECM

Variables	Coefficient	Std. Error	t-Statistic	Prob.*
D(INTR)	0.162882	0.025574	6.368966	0.0007
DLOG(GEMS)	0.1916669	0.440341	4.352691	0.0048
D(EXR)	-0.005920	0.002350	-2.519337	0.0453
D(CPI)	0.020931	0.003394	6.166324	0.0008
D(MCUR)	0.070811	0.018697	4.272564	0.0052
CointEq(-1)*	-0.516487	0.053226	9.703573	0.0001

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R-squared	0.970245	Mean dependent var	0.277825
Adjusted R-squared	0.918174	S.D. dependent var	0.575917
S.E. of regression	0.164742	Akaike info criterion	-0.516205
Sum squared resid	0.325680	Schwarz criterion	0.471440
Log likelihood	30.77548	Hannan-Quinn criter.	-0.179389
Durbin-Watson stat	2.372996		

Source: Author's computation

IV. Research Findings and Discussion

a) Short-Run (Dynamic) ARDL Model analysis

The Table 4.5 above shows the short run (dynamics) results. The optimal lag combination for the models is obtained via Schwartz Information criterion (SIC). The result in table 4.5 is the Error Correction Mechanism. It is the dynamic adjustment to the disequilibrium in the short run. It can be observed that INTR, CPI, GEMS and MCUR had positive impact on MANN while EXR had negative relationship MANN.

The results showed that INTR have a positive significant relationship with MANN at 5% significant level. This implies that as INTR increases MANN increases. The result, further shows that a 1% increase (decrease) in INTR on average, leads to about 0.162% increase (decrease) on MANN. This means that INTR contributed to MANN in Nigeria. This implies that as interest rate increases, the manufacturing output would increase. This does not conform to the a priori expectation.

Also, GEMS was found to have a positive significant relationship with MANN. This implies that as GEMS increases MANN increases. The result further shows that a 1% increase (decrease) in INFR on average leads to about 1.917% increase (decrease) on MANN. This implies that as more budgetary allocation is allocated to the manufacturing sector, the manufacturing output would increase. This conforms to the a priori expectation.

Furthermore, CPI was found to have a positive significant relationship with MANN. This implies that as CPI increases MANN increases. The result, further shows that a 1% increase (decrease) in INFR, on average leads to about 0.0209% increase (decrease) on MANN. This implies that as Nigeria has a general price level increases manufacturing output would increase. This conforms to the a priori expectation.

In addition, the results showed that MCUR have a positive significant relationship with MANN at 5% significant level. This implies that as MCUR increases MANN increases. The result also shows that a 1% increase (decrease) in MCUR on average leads to about 0.0799% increase (decrease) on MANN. This means that MCUR contributed to MANN in Nigeria. This conforms to the a priori expectation.

However, EXR is found to have a negative significant relationship with MANN. The result implies that as EXR increase MANN decreases. The result further shows that 1% increase (decrease) in EXR would lead to about 6.39 % decrease (increase) in MANN. This implies that as exchange rate increases, the manufacturing output reduces. This conforms to the a priori expectation.

The coefficient of most importance is the ECM coefficient. From the result the ECM term is well defined, that is negative and statistically significant at 5% level. The coefficient is -0.516which indicates approximately 51.6 percent of the previous year's disequilibrium in manufacturing productivity is been corrected by INTR, GEMS, EXR, CPI and MCUR. This also shows the speed at which the model converges to equilibrium. The magnitude of this coefficient implies that nearly 51.6 percent of any disequilibrium in manufacturing output is corrected by the some of the selected variable within one period (one year). The implication is that the present value of manufacturing output will adjust to changes in INTR, GEMS, EXR, CPI and MCUR

b) Summary of the Findings

The co-integration estimate showed the existence of a long run relationship among the variables in the estimated model.

The result of the regression estimate showed that Exchange rate and government expenditure on manufacturing sector variables has a positive and significant impact on manufacturing productivity, while consumer price index and manufacturing capacity utility rate variables has a negative and significant impact on manufacturing productivity but interest rate, has negative and insignificant impact on manufacturing productivity during the study period.

V. Conclusion

The focus of this study is on the relationships between exchange rate and manufacturing output in Nigeria over the period 1980 to 2020. Based on the regression estimates, the study concluded that exchange rate is a key determinant of manufacturing output in Nigeria. The study also concluded that Exchange rate, government expenditure on manufacturing sector, consumer price index, manufacturing capacity utility, and interest rate influences manufacturing output. Thus, the relationship between exchange rate and manufacturing output depends on the Exchange rate, government expenditure on manufacturing sector, consumer price index, manufacturing capacity utility, and interest rate.

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VI. Recommendation

From the findings discussed above, the following recommendations are offered in order to improve the relationship between exchange rate and manufacturing output in Nigeria:

In order to boast the level of Manufacturing output in Nigeria, there is the need for the government to manage or control the exchange rate in order promote export and support export - led growth, particularly in the provision of incentives and soft loans for export of locally produced manufacturing output. This will enable foreign exchange more available to the economy.

There is the need for Government to establish and implement policies that will encourage and protect infant industries so as for the new industry to compete in the international market.

Finally, there is the need to strengthen monetary policies in order to improve the exchange rate, maintain and improve the Manufacturing capacity utilization and increase Manufacturing Output in Nigeria.

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