Exchange Rate Trendand Manufacturingoutput Performance in Nigeria

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Abstract

This study examines the asymmetric effects of exchange rate on manufacturing sector performance in Nigeria. Manufacturing sector has been performing below anticipated level since the early 1980's and urgent solutions are required to correct the ill-performance of the sector. Emphasis on the earlier literature suggested core industrial policy rather than key macroeconomic policies such as monetary or trade policy. This paper employ monetary and trade policy proxies which include real exchange rate, trade balance and monetary policy rate. However, emphasis centers on asymmetric exchange rate effects. A new method to the problem of testing the presence of a level relationship between a dependent variable and a set of regressors is adopted. Thus,unlike the popular ARDL, the study adopted non-linear ARDL developed by Shin et al., (2013). This allows determination of independent positive and negative effects of exchange rate trend on manufacturing performance.Data set covers 1981 to 2016. It is found thatpositive change in exchange rate; that is exchange rate appreciation, is positively related with manufacturing in the long run whereas negative change or depreciation behaves otherwise. This suggests sustainability of lower exchange rate of naira to major foreign currencies is required in Nigeria stemming from the fact that Nigeria is a major importing nation and most manufacturing inputs are imported. Availability of cheaper and favourable foreign exchange to manufacturers is required for growth and sustainability of manufacturing in Nigeria.

Keywords: Manufacturing output, exchange rate, asymmetric effect, Non-linear ARDL

1. Introduction

Evidence from the literature on exchange rate management in developing countries suggests that most developing countries registered a persistent decline in foreign exchange earnings from the early 1980s attributed largely to the collapse of commodity prices in the world market (Egwaikhide, 1999). Worst situation stilldriving exchange rate problem on a global scale is the inability of some developing countries in South America to meet their debt obligations in the 1980s. The United States also increased cost of funds lending to foreign countries as a result of increase deficit financing of the United States economy. These series of actions sparked reactions and new economic reform policies in the developing countries. For instance,some of the policies adopted in developing countries in the mid-1980s include trade liberalization and dissolution of the Marketing

Board. These basically originated from the Bretton Woods School of thoughts as solution to negative effect of exchange rate on the real sector (Kwanashie et al., 1998). Nevertheless,one crucial argument in support of liberalization policy is the capacity to increase share of non-oil export of the gross domestic product (GDP).

According to the Bretton Woods Institution, low price competitive level of non-oil exports is caused by exchange rate overvaluation and marketing board penchant for profits. They suggested deregulation of exchange rate;open trade policy and dissolution of commodity board will promote favourable pricing of domestic output, increase production of tradeable goods and external competitiveness of non-oil tradeable goods (Kwanashie et al., 1998; Egwaikhide, 1999; Amassoma, 2017).However, over the years, anticipated effect of policy adjustment to correct the negative growth in the manufacturing sectoris yet to be realized. Meanwhile, in Nigeria for instance, the sector is earmarked as the engine of growth andproducer of non-tradeable goods than are germane to exports. The sector is expected to generate employment and reduce poverty rate. However, in spite of government policies to increase performance in the sector, there is yet to be a significant improvement. Following Central Bank of Nigeria statistical, the share of contribution of manufacturing to national output has been showing downward movement since the early 1980s. The sectoral growth of GDP recorded negative value since year 2013.

Several policies ranging from trade to fiscal or monetary policy have been employed to resolve poor performance of manufacturing. Import substitution and export promotion industrialization have been major policy thrust. How laudable these policies might have been, it is yet to produce expected results to offer solution to manufacturing negative growth in Nigeria. Nevertheless, there has been extensive use of macroeconomic policy to address manufacturing sector in Nigeria but long term exchange rate trend relative to manufacturing output is yet to be examined thoroughly.Also, there has been quite a number of literature on linear or symmetric effect of exchange rate on manufacturing,(Egwaikhide, 1999; Kandil, 2004;Amassoma, 2017), but none has examined asymmetric effect of exchange rate on manufacturing sector's output. The traditional auto regressive distributed lag model (ARDL) measures the lag effect of independent variable on dependent variables but this only captures linear effect. The question is that, what happens in the short run when exchange rate changes positively or negatively with respect to manufacturing sector? What are the long run asymmetric effects of exchange rate on manufacturing sector performance?

The non-linear ARDL or (NARDL) will be employed tocapturethe asymmetric effects. This is necessary because the method allows disaggregation of exchange rate series into positive and negative value and gives effect of both on manufacturing performance. Sometimes, exchange rate appreciation (positive change), or exchange rate depreciation (negative change) may reveal non-uniform effect in manufacturing performance. The effect of a particular change may be significant and positive while others respond otherwise. Therefore, this study explores advantages inherent in NARDL to analyse theasymmetric effect of probable exchange rate on manufacturing sector output performance in Nigeria. The historical dynamic analysis covers the period from1981 to 2016.

The study is divided into five sections; section one is the introduction. In section two, literature review and theoretical concept are addressed. Section three includes

methodology and model specification, and four, presentation of results. Conclusion and policy recommendations are presented in section five.

2. Literature Review and Theoretical Concept

2.1 Literature Review

There has been extensive literature on exchange rate effect on the real sector. The effects range from over-valuation of exchange rate, to exchange rate volatility effect, short run and long run effects and macroeconomic effect. However, the direct effect on manufacturing sector is yet to be adequately and scrupulously studied. What is widely acceptable in the literature is that macroeconomic environment plays a significant role in exchange rate determination (Edwards, 1989;Edwards, 1994;Montiel, 1997; Edwards, 1988).While most literature find that overvaluation of exchange rate can reduceoutput andemployment(Akinlo and Lawal (2012), others state depreciation is better to stimulate foreign demand for home produced goods(Khalid, and Aristomene, 1999; Opaluwa et al., 2010). However, in what appears to be general findings in developing countries, exchange rate depreciation is significantly uncomplimentary to national output growth. Most empirical literature findings show negative relationship between exchange rate and manufacturing sector (Akpan and Atan, 2011;Ehinomen and Oladipo, 2012;Imoughele et al., 2014;Amassoma, and Odeniyi, 2016; Alagidede and Ibrahim 2017).

In what seems to be a divergent opinion about exchange rate effect, Akinlo et al., (2015)employ Vector Error Correction Model (VECM) and confirm the existence of long run relationship between industrial production index and exchange rate but findings show that exchange rate depreciation has no perceptible impact on industrial production in the short run but had positive impact in the long run. Finally, the results show money supply explained a very large proportion of variation in industrial production in Nigeria. In some other research focusing on effect of exchange rate fluctuation, Adejumo & Ikhide (2017) and Amassoma (2017), concluded that effect of exchange rate fluctuation is ambiguous but relatively detrimental to manufacturing and investment performances in Nigeria.

The conclusion drawn from the literature signifies exchange rate ambiguous effects on the real sector but with high inclination toward negative effect. Nevertheless, none of the literature has examined asymmetry effect of exchange rate on manufacturing sector particularly for Nigeria.None has employed the advantage inherent in non-linear ARDL in disaggregating exchange rate effect where by appreciation and depreciation effects are captured independently. Therefore, this study attempts to resolve the problem by employing the NARDL popularized by Shin et al., (2013).

2.2 Relevant Theoretical Issues

Exchange rate theoretical concept can be viewed in diverse ways. For instance, it can be analysed relative to real sector output, price determination, stabilization security, or purchasing power parity. This study concentrates on price and real output determinationconcepts. Exchange rate is crucial in import and export demands andit plays a key role in the international economic transactions (Ajakaiye, 2001; Adeoye and Atanda2012). It is often said no nation can remain an autarky due to varying factor endowment which necessitates nations' interdependence. Nigeria, for instance, is an import dependent nation with high propensity to import finished goods compared to

intermediate inputs. Often, government attempt to ration foreign exchange distribution among various competing sectors to create sectoral growth balance. Manufacturing sometimes receives concessionary exchange rate to boost employment, production and reduce cost per unit. The multiplier effects occurring thereafter induce increase output and employment in the next period. Although critics claim this may reduce competiveness of the priority sector and since resources have alternative uses, such attempt may drive inefficient allocation of resources, prevent research and innovation as well as sustainable development, (Kwanashie et al., 1998;Dooley et al., 2003; Mastanduno, 2008;Eichengreen, 2011; Adebiyi, 2012).

Moreover,the importance of exchange rate derives from the fact that it connects the price systems of two different countries thereby making it possible for international trade to make direct comparison of traded goods. In other words, exchange rate links domestic prices with international prices.It is the goal of every economy to have a stable rate of exchange with its trading partners. In Nigeria, this goal has not been attained inspite of the fact that the country has embarked on devaluation of her currency to promote export and stabilize the rate of exchange. The inability of the economy to achieve this exchange rate stability has subjected every sector of the economy to the challenge of a constantly fluctuating exchange rate (Nnanna, et al., 2003).

Monetary policy rate and trade balance can also be determining factor co-integrating with exchange rate in determining manufacturing performance (Engel and Hakko, 1993; Mordi et al., 2010 & 2014; Ezike, 2012). In addition, the trilemma concept reminds researchers and policy makers the need to balance monetary policy decision among economic openness, money growth and floating exchange rate. Engel and Hakko (1993), Udebo (1994) and Ogunwa (1996) submitted that normally, changes in money stock would influence exchange rate, interest rates, output and prices in the short run. Adding that money supply and interest rate are important channels through which activities in the financial sector are transmitted to the real sector. Ceteris paribus, expansion in money stock will stimulate aggregate spending and output (Esike, 2012). However, where shortfalls exist, be it foreign exchange bottlenecks, productivity gaps, or technological deficiency, monetary expansion tends to be inflationary. Consequently, if aggregate demand increases, following increase in money supply, demand for import would be stimulated and pressure is exerted on the exchange rate and balance of payments. A decline in monetary expansion, however, leads to recession and unemployment.

2.3 Theoretical Framework

The framework derived in this study is a hybrid of monetary and trade policies. It incorporates knowledge derived fundamentally from the classical and Keynesian models. Ideology is also borrowed from Mckinnon-Shaw (1973), Lucas (1975), and Mordi et al., (2014) which explained theoretical relationship between monetary or financial instruments and the real sector of the economy.However, most relevant is the absorption approach which explains the effectiveness of exchange rate devaluation on the real sector. It is a modified simple Keynesian model viewing economic condition in the context of aggregate demand and supply relative to domestic currency devaluation while aiming at balancing the current account. Following Tule (2013), a simple national income mathematical notation can be derived to explain the absorption approach as equation (1) below:

$$Y = C + I + G + X - M \quad (1)$$

$Y =$ National Income; C = Consumption expenditure (of the private sector); I = Private investment expenditure; G = Government expenditure; X = Export and M = Import.

$$A = C + I + G \quad (2)$$

In equation 2, A is the domestic demand or "absorption" identity. The current account CA is $X - M$. Other items like official development assistance (ODA) grants and factor income etc, are held constant. Assuming $CA = X - M$, it can be expressed that $X - M = Y - A$ or $CA = Y - A$

This model implies that a country facing a deficit probably has two options: either increase Y or decrease A. Increasing Y is a supply-side problem. The International Monetary Fund (IMF) suggestion economic liberalization instruments like free trade, privatization, deregulation (especially of the exchange rate), among others, would favour private sector investment and boost output. On the-other-hand", decreasing A is a demand-side problem. Usually, it means austerity-tight budget, tight monetary policy and regulated exchange rate" (Edwards, 1988; Tule, 2013).

3. Methodology

3.1 Model specification

The model basically explains exchange rate effect on manufacturing sector in Nigeria in Equation 3 below:

$$MANOUT = F(TB, MPR, EXR) \quad (3)$$

Where:
MANOUT = Manufacturing output
TB = Trade balance
MPR = Monetary policy rate
EXR = Real exchange rate

Output of manufacturing sector is a measure of performance of the sector. An inverse relationship is expected between exchange rate and manufacturing sector. Trade balance is the ratio of export to import which is expected to be positively related with manufacturing sector. A higher ratio means rising volume of export or declining import relative to export. Monetary policy rate is the source of all interest rates in Nigeria. No financial sector operator would lend below the CBN rate.

Objective of this study is to capture the asymmetric effect of exchange rate on the manufacturing sector output performance in Nigeria. This leads to the non-linear auto regressive distributed lag (NARDL) approach to co-integration. The NARDL is a modified innovative version of ARDL developed by Pesaran & Pesaran (1997); Pesaran and Shin (1999); (1998); Persaran., (2001); Shin et al., (2009; 2013).

It begins with the asymmetric co-integrating regression:

$$Y_t = \alpha^+ X_t^+ + \alpha^- X_t^- + \mu_t \quad (4)$$

where α^+ and α^- are the associated long-run parameters while, X_t is a k×1 vector of regressors

decomposed as:

$$X_t = X_0 + X_t^+ + X_t^- \quad (5)$$

X_t^+ and X_t^- are partial sum processes of positive and negative changes in X_t :

Assuming; $EXR_t\_P = X_t^+ = \sum_{i=1}^{r} \Delta X_j^+ = \sum_{i=1}^{r} \max(\Delta X_j, 0)$ and (6)

$$EXR_t\_N = X_t^- = \sum_{i=1}^{r} \Delta X_j^- = \sum_{i=1}^{r} \min(\Delta X_j, 0), \quad (7)$$

where EXR is the real interest in year t; then the NLARDL in equation 8 can be established.

3.2 Effect of Exchange Rate and Other Relevant Macroeconomic Variables on Manufacturing Sector Performance in Nigeria

$$\Delta MANOUT_t = \delta_0 x + \sum_{i=1}^{r} \delta_1 \Delta MANOUT_{t-i} + \sum_{i=0}^{r} \delta_2 \Delta TB_{t-i} + \sum_{i=0}^{r} \delta_3 \Delta MPR_{t-i} + \sum_{i=0}^{r} \delta_4 \Delta EXR\_P_{t-i} + \sum_{i=0}^{r} \delta_5 \Delta EXR\_N_{t-i} + \phi_1 MANOUT_{t-1} + \phi_2 TB_{t-1} + \phi_3 MPR_{t-1} + \phi_4 EXR\_P_{t-1} + \phi_5 EXR\_N_{t-1} + \mu_t \quad (8)$$

Equation (8) is the NARDL bound test equation whereEXR_P denotes sum of positive changes in exchange rate and EXR_N denotes sum of negative changes. δ_0 = vector of coefficients of deterministic variables. Δ = first-difference operator. r = optimal lag length; μ_t = the residual term. Equation (8) can be dis-aggregated into long run and short run asymmetric error correction *(AECt)* terms. Equation (9) is the long run model while (10), the short run model.

$$MANOUT_t = \delta_0 + \phi_1 MANOUT_{t-1} + \phi_2 TB_{t-1} + \phi_3 MPR_{t-1} + \phi_4 EXR\_P_{t-1} + \phi_5 EXR\_N_{t-1} + \mu_t \quad (9)$$

To find the short run coefficients, the following asymmetric error correction equation is employed:

$$\Delta MANOUT_t = \delta_0 x + \sum_{i=1}^{r} \delta_1 \Delta MANOUT_{t-i} + \sum_{i=0}^{r} \delta_2 \Delta TB_{t-i} + \sum_{i=0}^{r} \delta_3 \Delta MPR_{t-i} + \sum_{i=0}^{r} \delta_4 \Delta EXR_t\_P_{t-i} + \sum_{i=0}^{r} \delta_5 \Delta EXR_t\_N_{t-i} + \psi AECt_{t-1} + \pi_t \quad (10)$$

Where $AECt_{t-1}$ is the asymmetric error correction term and ψ, the coefficient of *AECt* that measures the speed of adjustment to equilibrium and is expected to be negative. The null hypothesis for bound testing is given as:

$H_O : \phi_1 = \phi_2 = \phi_3 = \phi_4 = \phi_5 = 0$ (Long-run relationship does not exist)

$H_1 : \phi_1 \neq \phi_2 \neq \phi_3 \neq \phi_4 \neq \phi_5 \neq 0$ (Long-run relationship exists)

4. Presentation of Results

Table 3:Bound Test Results and Wald Statistics Critical Value (eq. 8)

Maximum Lag	AIC	SIC	HIC	PESARAN TABLE		Wald Statistic Critical Value
				Lower Bound	Upper Bound	
1	1.5257	1.2068	1.3578	2.62	3.79	2.69
2	1.6571	0.9243	1.4142	2.62	3.79	2.67
3	1.7951	0.1962	1.5086	**2.62**	**3.79**	**3.81**

Source: Authors Computation

In this section, model (8) isestimated to check for bound test relationship between manufacturing output and exchange rate, trade balance and monetary policy rate and in addition, lag value of manufacturing output. Estimation is based on the lag difference of each variable using yearly data from 1981-2016. Following the literature Bahmani-Oskooee andFariditavana (2015), a maximum of three lags on each firstdifferenced variable is imposed and use Akaike's Information Criterion (AIC) to select the optimumlags. Unit root test shows variables are integrated of order I(0) and I(l) a condition necessitating bound test, unlike Johansen co-integration which requires uniform order of integration (Karantininis et al., 2011). Thus, testing for unit root in ARDL may be unnecessary (Pesaran et al., 2001).

Results from each optimum model are reported in tables 3, 4 and5. Table 3 above reports the co-integrating relationship between the variables. Bound relationship is established between macroeconomic variables and manufacturing output for the Nigerian economy in the years under review. The bound relationship is proved by the Wald critical value (3.81) which is greater than Pesaran's upper bound critical value (3.79). The study therefore proceeds further to estimating asymmetric long run and short run coefficients.

Table 4: Short Run NARDL Result

Regressors	Sort Run Model (eq. 9) Dependent Variable = MANOUT			
	Coefficients	**Standard Error**	**T-Statistic**	**Probability**
MANOUT((-1)	0.0259	0.2460	0.1055	0.9174
MPR(-1)	0.0016	0.0083	0.2015	0.8432
MPR(-2)	-0.0077	0.0093	-0.8302	0.4203
TB(-1)	-0.0401	0.0643	-0.6234	0.5430
TB(-2)	0.0429	0.0535	0.8009	0.4366
EXR_P(-1)	-0.0039*	0.0018	-2.1016	0.0542
EXR_P(-3)	-0.00339*	0.0021	-1.8107	0.0917
EXR_N(-1)	0.0296	0.0174	1.7002	0.1112
AECT(-1)	-4.7105*	2.6405	-1.7838	0.0961

*****, **, *** = Significant at 1%, 5% and 10% level; eq = equation

Asymmetric error correction term in table 4 is significant at 5% and shows a high speed of convergence to long run equilibrium.The short run asymmetric relationship is recorded;exchange rate appreciation is significantand inversely related with manufacturing performance. However, exchange rate depreciation is positive but not significant. This means that in the short run, devaluation of domestic currency will stimulate exportby increasing foreigners' purchasing power; the reverse is the case in the event of appreciation. Monetary policy rate and trade balance are both not significantly related with manufacturing performance in the short run. Stiglitz (2016) advocated that fiscal stimulus is much better to address the real sector than monetary stimulus.

Table 5. Long Run Non-linear ARDL Result

Regressors	Long Run Model (eq. 9) Dependent Variable = MANOUT			
	Coefficients	**Standard Error**	**T-Statistic**	**Probability**
MANOUT(-1)	0.9870***	0.0582	16.9327	0.0000

MPR(-1)	1.4138	17.9273	0.0788	0.9378
TB(-1)	13.5957	151.643	0.0896	0.9293
EXR_P(-1)	8.6269**	4.1566	2.0754	0.0488
EXR_N(-1)	-64.5410	46.7477	-1.3806	0.1801
C	84.2660	355.866	0.2367	0.8148

Goodness of Fit and Residuals Diagnostics Tests

R^2	0.8915 or 89%
F-statistics	314.254 (0.0000)
χ^2 Serial corr. (LM Test)	9.1812 (0.0913)
χ^2 White Heteroscedasticity	2.9989 (0.2152)

*****, **, *** = Significant at 1%, 5% and 10% level; ( ) Probability value;

Having carried out the residual diagnostic tests, it is found that the model passes serial correlation and heteroscedasticity as well as goodness of fit. In the long run, asymmetrically, whileexchange rate appreciation is directly and significantly related with performance of manufacturing sector, deprecation is inversely related. That is, the higher the exchange rate, the lower the capacity to produce and export. This may be as result of the fact that Nigerian manufacturers rely solely on imported inputs to complement production. A high rate of exchange reduces capacity to import inputs, increases output prices and consequently reduces production level. Whereas, exchange rate appreciation means increasing manufacturer's purchasing power and the ability to import more inputs. Monetary policy rate is not significant in the Nigerian economy. Trade balance is positively related but not significant. However, if manufacturing output performs significantly in the present period, it will definitely perform better in the next period following the positive sign and significance of the coefficient.

Figure 6: Stability Test

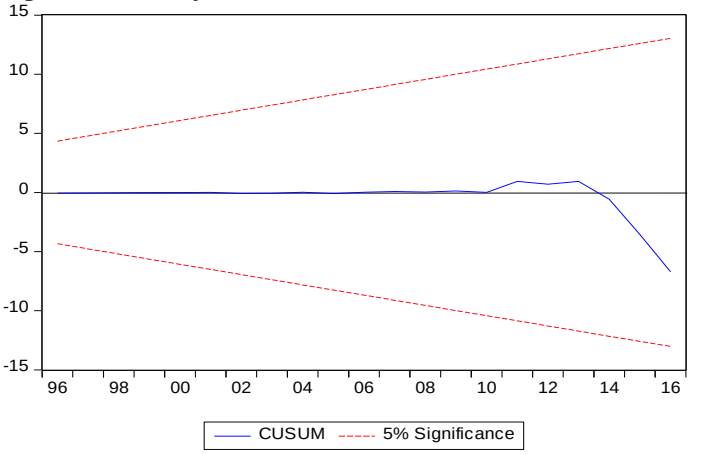

Figure six shows there is stability within the period and the model is reliably good for policy framework.

5. Summary and Conclusion

Empirical analysis of effect of exchange rate on manufacturing sector has been an integral part of research on the real sector. In Nigeria, there has been research since the era of national development planning in the 1960s to formulate appropriate policy measures to address the industrial sector and manufacturing sub-sector in particular. However, the emphasis on this earlier literature suggested core industrial policy rather than key macroeconomic policy such as strict monetary or trade policy. This paper employ monetary and trade policy proxies which include real exchange rate, trade balance and monetary policy rate. Although, the main objective is to examine the asymmetric effect of exchange rate on manufacturing sector, two complementary variables are co-examined. This paper advances a new method to the problem of testing the presence of a level relationship between a dependent variable and a set of regressors, especially when it is unknown significantly whether the regressors are trend or first-difference stationary. Unlike the popular ARDL, the study adopted non-linear ARDL developed by Shin et al., (2013).

The main findingis unique. Unlike previous findings from (Akpan and Atan, 2011; Imoughele et al., 2014;Amassoma, and Odeniyi, 2016; Alagidede and Ibrahim 2017), by employing asymmetric ARDL principle, positive change in exchange rate, that is exchange rate appreciation, is positively related with manufacturing in the long run whereas negative change or depreciation behaves otherwise. This means that sustainability of lower exchange rate of naira to major foreign currencies might be required in Nigeria. This stems from the fact that Nigeria is a major importing nation and most manufacturing inputs are imported, therefore, manufacturers require lower or favourable exchange rate to achieve optimal production level. Evidence from this study establishes that the availability of a cheaper and favourabe foreign exchange to

manufacturers and producers in the real sector of Nigeria iscritical to the growth and sustainability of manufacturing.

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