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THE IMPACT OF EXCHANGE RATE FLUCTUATION ON INDUSTRIAL OUTPUT IN NIGERIA.

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Abstract

Exchange rate management is an important tool of monetary policy not only because of its influence on external balance but also because of its effect on the level of output. This paper examines the effect of exchange rate fluctuations on industrial output in Nigeria. The study used quarterly time series data to explain the effect of exchange rate and other variables on industrial output. The explanatory variables included are money supply, inflation, government capital expenditure, foreign direct investment and exchange rate. The study employed the Autoregressive Distributive Lag (ARDL) model to examine the effect of current and previous values of explanatory and dependent variables on the dependent variable.The result shows inflation and money supply has a significant effect on industrial output. However, the result suggests a negative but weak relationship between exchange rate and industrial output.

Keywords: Exchange rate, Inflation, Money supply, Monetary policy

1. Introduction

Nigeria has been faced with a volatile exchange rate fluctuation since 1986. In recent time, the problem has been fuelled with the dwindling oil revenue resulting from the fall in the price of oil in the world market. The CBN made several effortsto defend the currency but eventually had to weaken it because of the large demand for foreign currency and also to bridge the wide gap between the official rate and the bureau de change rate.

Exchange rate management is an important tool of monetary policy not only because of its influence on external balance but also because of its effect on the level of output. In theory, changes in exchange rate affects output through its effect on net export. All other things being equal, adepreciation of the currency improves trade balance and the aggregate output and vice versa. The situation is however different in Nigeria because the country is largely dependant on import and rely majorly on the revenue from the export of crude oil. The exchange rate policy required in such situation would involve some structural transformation such as reducing imports or expanding the non-oil exports, which eventually leads to a depreciation of the nominal exchange rate (Eme & Johnson, 2012). The success of currency depreciation in promoting trade balance largely depends on switching demand in proper direction and amount, aswell as on the capacity of the home economy to meet the additional demand by supplying more goods (Kadil & Mirzaie, 2005)

As a result of the shortages in foreign exchange, companies have been deprived the ability to import input for production. This could lead to shortage in output and if not checked for a long period, may result in inflation and contraction of the economy. The Nigerian industry consists of themanufacturing, crude petrol and solid minerals. Crude oil and manufacturing constitutes a major part of the industrial and total output. Any shock distorting the activities of these sectors would have a serious implication on the economy as a whole.

Hence, the major objective of the paper is to examine the effect of exchange rate fluctuations on industrial outputin Nigeria.

Literature Review

Theoretical Review

Theories relating to this study include the exchange rate theories and growth theories. Exchange rate theories explainthe behaviour of exchange rate in the real world. Growth theory and accounting explains the factors influencing output growth.

Growth theories explain how economic decisions affect the accumulations of factors of productions.Growth accounting explains the relationship between factors input and production output. It can as well be used to explain the effect of other factors on output. The Neoclassical growth theory studies the way that growth in the capital stock per worker affects the long-run level of output. Neoclassical growth theory attributes long-run growth to technological progress but leaves unexplained the economic determinants of that technological progress. Endogenous growth model emphasises the role of knowledge capital, which is faced with increasing marginal returns.

The earliest and simple model explaining exchange rate determination is the purchasing power parity (PPP) Theory that explains that prices will adjust with changes in National price level under floating exchange rate. Empirical evidences of the theory however suggest deviation of currencies from the PPP. The inability of the PPP to give a satisfactory explanation of the behavior of exchange rate led to further development of theories of exchange rate determination. One major setback of the PPP theory is that it was not able to explain the international capital movement. The speculations and expectations of investors influence the composition of currency they would keep in their portfolio. These would determine the currencies they would buy or sell thereby affecting movement of capital across countries.

The monetary models emphasize the role of money supply on exchange rate. The models were built on the PPP theory. The flexible price monetary model assumes that price level adjust to changes in demand and supply of money which leads to its adjustment to the PPP. The sticky price monetary model of exchange rate explains the volatility and misalignment of exchange rate and how monetary policies instability can further affect the instability.

The portfolio model allows for changes in perceived risk in the determination of exchange rate, which was a drawback for the monetary models. The model did not however deal with the precise reason for the differences in perceived risk.

Empirical Framework

Many studies have been conducted on the impact of the exchange rate fluctuations on manufacturing sector output. Few of the studies have reported positive effect of devaluation (depreciation) on output (Terence & Pentecost, 2001). Contrariwise, some studies have reported a negative impact of depreciation (devaluation) on output (Sheeley,1986; Rogers & Wang, 1995). Also, few studies have argued that real exchange rate may produce negative or positive impact on output in the short run but neutral in the long run (Edwards 1986; Kamin&Klau, 1998). With regard to the impact of exchange rate on industrial production, the impact follows the same pattern as aggregate output outlined above. Exchange rate deregulation that increases investors' access to foreignexchange can lead to increased industrial output. Increased access to foreign exchange will enable the investors procure the needed imported raw material and equipment needed for production. So, industrial output canbe enhanced. Moreover, increased production can lead to increased employment, which may eventually lead toimproved wages and increased economic growth. Also, exchange rate depreciation can lead to increased industrial output where domestic firms are exporters.

According to the study by Jongbo (2014), on the impact of real exchange rate fluctuation on industrial output in Nigeria, it is revealed that exchange rate is significant in determining the industrial output. Also, in the study by Akinlo and Lawal (2015), on the impact of exchange rate on industrial output in Nigeria using Vector Error correction Model (VECM) shows that there is existence of long run relationship between industrial production index, exchange rate, money supply and inflation. The work specifically revealed that exchange rate depreciation had no perceptible impacts on industrial production in the short run but had positive impacts in the long run. Abdallah (2015), shows, in his study: exchange rate variability and manufacturing sector performance in Ghana: evidence from cointegration analysis, that there is existence of both short as well as long run relationship between exchange rate and manufacturing sector performance. Thus, in Ghana as the exchange rate appreciates, the manufacturing sector performance improves and as it depreciates, the sector is adversely affected.

In congruence with the above, is the study by Adeniyi (2012) on employment effect of exchange rate volatility in Nigeria's manufacturing sector using Generalised Autoregressive conditional Heteroscedasticity(GARCH), the results revealed that exchange rate volatility has significant positive effects on employment in manufacturing sector through the export orientation channel; though, with an insignificant effects through import penetration channel. Another research related to the foregoing is the work of MansorandRuzita (2005) which studies the impact of exchange rate and monetary policy on manufacturing sector output in Malaysia. It is shown is the results that manufacturing output is greatly affected than aggregate output. It equally revealed in the result that the temporal response of manufacturing output seems to coincide with the aggregate output responses but precede other output reactions

However, Austin (2015), while investigating the impact of exchange rate on output and growth in gross domestic product in Nigeria; a comparative analysis, using OLS regression, found that the exchange rate regimes in Nigeria do not influence the level of output , contrary to expectation. In relation to the foregoing, the study by Christopher and Tomilade(2012), on the exchange rate management and the manufacturing sector performance in the Nigerian economy using Ordinary Least Square (OLS) multiple regression analysis, the result shows that depreciation which forms part of the structural adjustment policy (SAP) 1986, and which dominated the period under review has no significant relationship with the manufacturing sector productivity. It was found that in Nigeria, exchange rate appreciation has a significant relationship with domestic output. And that exchange rate appreciation will promote growth in the manufacturing sector.

Conversely, a study by Eme and Johnson (2014) on the effect of exchange rate movements on real output growth in Nigeria. Based on quarterly series for the period 1986 to 2010, the study examines the possible direct and indirect relationship between exchange rates and GDP growth. The relationship is derived in two ways using a simultaneous equations model within a fully specified (but small) macroeconomic model. A Generalised Method of Moments (GMM) technique was explored. The estimation results suggest that there is no evidence of a strong direct relationship between changes in exchange rate and output growth. Rather, Nigeria's economic growth has been directly affected by monetary variables. These factors have tended to sustain a pattern of real exchange rate, which has been unfavourable for growth

In a sharp contrast with the findings above, Magda and Ida (2005), in their study on the effects of exchange rate fluctuations on real output and prices in a sample of 33 developing countries using theoretical model that decomposes

movements in the exchange rate into anticipated and unanticipated components. Unanticipated currency fluctuations determine aggregate demand through exports, imports, and the demand for domestic currency, and determine aggregate supply through the cost of imported intermediate goods. Anticipated exchange rate depreciation, through the supply channel, has limited effects on output growth and price inflation. Unanticipated currency fluctuations appear more significant with varying effects on output growth and price inflation across developing countries.

Methodology

Theoretical Framework and Model Specification

On a general note, the Cobb-Douglas production function has remained the most acceptable means for analyzing productivity or output in theory and in practice most especially and as demonstrated a priori in the industrial sector. It is on this note that this study focuses on the adoption of the Cobb-Douglas production in the form of:

$$Y = AK^{\alpha}L^{\beta} \quad (1)$$

Where: Y= Output, A = efficiency of Labour, K = Capital, L= Labour, $\alpha and \beta$ are less than one, indicating diminishing returns to single factor.

The above model fails by ignoring some other factors influencing output. It also ignores the role of exchange rate fluctuations, foreign direct investment, government expenditure on capital project, inflation rate, etc. As a result of this, endogenous growth model suggests other exogenous variables such as government spending, human capital and demographic factors. Mankiw et al. (1992) subscribes to this as follows:

$$Y = AL^{\alpha 1}K^{\alpha 2}N^{\alpha 3} \quad (2)$$

Where: Y = Output, N = Additional inputs

The above model is employed to examine the impact of exchange rate fluctuations on industrial output as given below:

$$\log(IND.OUTP)_t = \beta_0 + \beta_1 \log(CAP.EXP)_t + \beta_2 \log(MON.SUP)_t + \beta_3 \log(FDI)_t + \beta_4 INF_t + \beta_5 EXT_t + \mu_t \quad (3)$$

Where: IND.OUTP = Aggregate industrial output
CAP. EXP = Capital Expenditure
MON. SUP = Money supply
FDI = Foreign Direct Investment
INF = Inflation rate
EXT = Exchange rate
$\beta_0 - \beta_5$ = Coefficient parameters
μ_t= Error Term

Log was introduced to the above model to ignore the magnitude differences in the variables. Also, due the nature of the data used in this data, we employed Autoregressive Distributive Lag Model (ARDL) to address the fundamental objective of this study. The model is formulated below:

$$\log(IND.OUTP)_t = \beta_0 + \beta_1 \log(CAP.EXP)_t + \beta_2 \log(MON.SUP)_t + \beta_3 \log(FDI)_t + \beta_4 INF_t + \beta_5 EXT_t + \beta_6 \log(IND.OUTP)_{t-1} + \beta_7 \log(CAP.EXP)_{t-1} + \beta_8 \log(MON.SUP)_{t-1} + \beta_9 \log(FDI)_{t-1} + \beta_{10} INF_{t-1} + \beta_{11} EXT_{t-1} + \mu_t$$

(4)

Data Requirement and Sources

Quarterly time series data for the period between 1995 and 2015 on industrial output, foreign direct investment, capital expenditure, inflation rate, exchange rate and money supply in Nigeria. These Data were sourced from Central Bank of Nigeria Statistical Bulletin 2014 and 2015.

Data Estimation and Analysis

Prior to estimation of ARDL model in equation 4, standard econometrics tests namely Stationaritytest and Cointegration test were undertaken in order to avoid generation of spurious regression results and to find the long run relationship between the dependent and independent variables. The Autoregressive Distributive Lag (ARDL) model was equally utilized to examine the effect of current and previous values of explanatory and dependent variables on dependent variable.

3.Results and Discussion

Table 1: Unit Root Test

The stationary of the data was tested using the Augmented Dickey-Fuller (ADF) and Philip Peron test. The result presented in table 1 below shows that series have unit root. The ADF and PP values for all the variables are greater than Mackinnon critical values at 1% and 5% implying that these variables are stationary at first difference. Since all the variables are I(I) series, test for cointegration between the variables is employed.

Variables	ADF	PP	ADF	PP	Order of Int.
IND. OUTPUT	-2.3417	-2.3271	-10.4428	-10.4428**	I(I)
CAP. EXP	1.0003	1.6082	-1.20005	-3.5992**	I(I)
EXT RATE	-0.9864	-1.0038	-8.4365***	-8.4365***	I(I)
FDI	-1.2872	-4.1545	3.7325	-4.9888**	I(I)
INF	1.5135	-1.4783	-9.0346	-9.05877**	I(I)
MON. SUPPLY	2.5965	2.4859	-3.2585	-10.9090**	I(I)

Note: *,**,*** denotes1%, 5% and 10% order of integration respectively.

Table 2: Engle Granger Cointegration Test Results

Date: 10/07/16 Time: 03:28
Series: CAP_EXP EXT FDI IND_OUTPUT INF MON_SUP
Sample: 1995Q1 2015Q4
Included observations: 84
Null hypothesis: Series are not cointegrated
Cointegrating equation deterministics: C
Automatic lags specification based on Schwarz criterion (maxlag=11)

Dependent	tau-statistic	Prob.*	z-statistic	Prob.*
CAP_EXP	-3.019594	0.7375	-17.50506	0.6990
EXT	-3.310932	0.6009	-16.75805	0.7342
FDI	-5.453385	0.0135	-41.59609	0.0196
IND_OUTPUT	-3.895868	0.3169	-26.45260	0.2834
INF	-3.916783	0.3080	-19.15591	0.6177
MON_SUP	-3.947586	0.2950	-25.85247	0.3064

*MacKinnon (1996) p-values.

The result on table 2 reveals that the variables are not cointegrated since the probability values of tau and Z- statistics for most of these variables are greater than the level of significance, we therefore accept the null hypothesis and conclude that the variables are not cointegrated. With regard to the central objective of this paper to examine the impact of exchange rate fluctuations on industrial development in Nigeria, Table 3 presents the Autoregressive Distributive Lag Model results.

Table 3 : Autoregressive Distributive Lag Model Result

Dependent Variable: LOG(IND_OUTPUT)
Method: ARDL
Date: 10/24/16 Time: 03:37
Sample (adjusted): 1995Q2 2015Q4

Included observations: 83 after adjustments
Dependent lags: 1 (Fixed)
Dynamic regressors (1 lag, fixed): LOG(CAP_EXP) EXT LOG(FDI) INF LOG(MON_SUP)
Fixed regressors: C

Variable	Coefficient	Std. Error	t-Statistic	Prob.*
LOG(IND_OUTPUT(-1))	0.657980	0.093654	7.025662	0.0000
LOG(CAP_EXP)	-0.261556	0.192402	-1.359427	0.1783
LOG(CAP_EXP(-1))	0.229697	0.176796	1.299223	0.1981
EXT	-0.001849	0.001848	-1.000887	0.3203
EXT(-1)	0.002059	0.001882	1.094307	0.2775
LOG(FDI)	-0.005347	0.161973	-0.033010	0.9738
LOG(FDI(-1))	0.025017	0.161428	0.154972	0.8773
INF	-0.003059	0.001201	-2.546303	0.0131
INF(-1)	0.002268	0.001342	1.690392	0.0953
LOG(MON_SUP)	0.369106	0.209222	1.764184	0.0820
LOG(MON_SUP(-1))	-0.140166	0.202124	-0.693466	0.4903
C	-0.656520	0.570780	-1.150217	0.2539

R-squared	0.977859	Mean dependent var	7.248607
Adjusted R-squared	0.974429	S.D. dependent var	0.813246
S.E. of regression	0.130046	Akaike info criterion	-1.108863
Sum squared resid	1.200747	Schwarz criterion	-0.759151
Log likelihood	58.01781	Hannan-Quinn criter.	-0.968368
F-statistic	285.0678	Durbin-Watson stat	1.985203
Prob(F-statistic)	0.000000		

*Note: p-values and any subsequent tests do not account for model selection.

The above result shows that money supply influenced industrial output positively in Nigeria during the year under review. That is one percentincrease in money supply increases industrial output by 0.24 percent increase in industrial output in Nigeria. This implies that as the government pump more money to circulation through credits to private sector or any other means, industrial output responds positively. Inflation rate in Nigeria has a negative impact on industrial output in Nigeria. A unit increase in inflation rate lead to 0.3 percent decrease in industrial output in Nigeria. This means that an increase in inflation rate reduces real wage rate. Also one percent increase in Foreign direct investment increases industrial output by 0.005 percent. Capital expenditure has a negative impact on industrial output, one percent increase in capital expenditure reduces industrial output by 0.26percent. Lastly, exchange rate which is the main explanatory variable of interest influenced industrial output negatively. This implies that a unit increase in exchange rate lead to 0.1percent unit decrease in industrial output in Nigeria.

The coefficient of determination (R^2) shows that 97 percent variations in industrial output is explained by all the explanatory variables. The Durbin-Watson statistics shows that theiris no evidence of serial correlation in the model. The overall probability statistics show that the model has high goodness of fit.

Conclusion

The study analyzed the effect of exchange rate fluctuations on industrial output in Nigeria. The stationarity of the variables were tested and all the variables were integrated at first difference. Engel-Granger Cointegration test was employed to examine the long-run relationship between the variable. The result indicated that the variables were not cointegrated. The study then proceeded to estimate the ARDL model for the variables. Based on the output, exchangerate, which is the major variable of interest, revealed a negative but weak effect on industrial output. Money supply and inflation shows a significant relationship on industrial output. Although, the analysis shows that exchange rate fluctuation does not affect the manufacturing output directly; it may affect it through its effect on inflation since the industry is dependent on importation of raw materials. A depreciation of the exchange rate could translate into an increase in price level as importation would be very expensive.

The policy implication of the findings is the need for monetary policy framework to support the exchange rate policy as there might be exchange rates pass through to inflation effect on the industrial output

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