EXCHANGE RATE VOLATILITY AND MANUFACTURING SECTOR OUTPUT IN NIGERIA

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ABSTRACT

This study empirically investigated the relationship between exchange rate volatility and Nigeria's manufacturing sector output by utilising both official and parallel market exchange rates. Secondary time series data for the official and parallel exchange rates as well as manufacturing sector contribution to Gross Domestic Product that span 1982 to 2019 were sourced from the CBN's annual statistical bulletin and analysed by a combination of descriptive and econometric analytical techniques that include mean, skewness, Ordinary Least Square, Pairwise Granger Causality test, and the GARCH model. From the results it was found that official exchange rate volatility has a negative relationship with manufacturing output, while parallel market exchange rate volatility is positively related to manufacturing sector output in Nigeria. Both variables are further observed to be independently insignificant, but collectively significant. There is also unidirectiomal causal relationship spilling from official exchange rate volatility to

manufacturing sector output and parallel market exchange rate volatility to manufacturing sector output. Consequently, it is recommended (among others) that activities of the parallel FX market should be curtailed, and the official market should be made accessible to manufacturers.

INTRODUCTION

It is not sheer coincidence, but a consequence of interaction between core macroeconomic variables that in 1986, during the implementation of the Structural Adjustment Programme (SAP), the naira lost its exchange advantage (in comparison with the US Dollar), by losing over 460% of its value, the manufacturing sector also recorded its slowest growth in a decade. This is a pointer to the pivotal position of exchange rate in steering growth in general and manufacturing in particular. Remarkably, its volatility culminates in short term distortions, medium term concerns and long term business concerns to the industrial sector. Thus real economic decisions are heavily hinged on the status of exchange rate.

This is in fact heightened by the stack reality that manufacturing firms in Nigeria almost always depend on foreign countries for production equipment, technology and other capital goods, whose payment is often denominated in foreign currency. This implies Nigeria's industrial sector is absolutely exposed to exchange rate volatility and its attendant consequences of transaction and economic exposures. Besides, some foreign expatriates engaged by these firms are paid in foreign currency. This could in no small measure affect planning and pricing by manufacturing firms, especially given the shallow state of the financial market which lack a robust derivatives market where avenues that could mitigate such exposures might be explored. This is in consonance with economic postulations which theorise that exchange rate volatility is adversely related to growth as changes in currency rates heighten uncertainty (Clark, 1973) which culminates in fluctuations in anticipated prices, and a potential change in demand for capital goods to limit risk exposure (Sugiharti, Esquivias and Setyorani, 2020).

Several local and global studies on exchange rate volatility have provided startling and varied observations as regards the interplay of exchange rate and other macroeconomic variables and phenomena (Ayobami, 2019). This

underscores the inconclusiveness of findings on the subject. For instance, Aderemi (2019) provides empirical evidence of inverse relationship between exchange rate volatility and capital flows into Nigeria. This was replicated by Olofsson (2019) and Barguellil, Salha and Zmami (2018) in international studies that relate to economic growth. The result was the same as shown by Alagidede and Ibrahim (2016) in Ghana. As regards its association with trade and manufacturing negativity is seen in (Ndidi and Ogedegbe, 2019; Latief and Lefen, 2018; and Clark, Tamirisa and Wei, 2004; etc) and (Aidi, Saidu and Suleiman, 2018; Olufayo and Fagile, 2014 and Opaoluwa, Umen and Abu, 2010) respectively. On the other hand, direct relationship has been observed between exchange rate volatility and trade (Siddiqui and Erum, 2016; and Backman, 2006) on one hand and manufacturing sector performance on the other (Ayobami, 2019; Oseni, Adekunle and Alabi, 2019; Akinlo and Adejumo, 2014 and Enekwe, Ordu and Nwoha, 2013).

Furthermore, the applicable exchange rate policy in Nigeria is quite unique as both fixed and floating/flexible regimes are practiced in the financial system which birthed the official market with fixed (but regulated) exchange rate policy and the parallel (black market) also referred to as bureau de change where foreign exchange prices are flexible and solely determined by forces of demand and supply. Consequently, this study considers how both official and parallel exchange rates affect the manufacturing sector output in Nigeria.

LITERATURE REVIEW

Exchange rate is the price of one currency in terms of another. This is in consonance with the position of Umaru, Aguda and Davies (2019) that exchange rate is the currency rate of a country in terms of the currency of another country. There are two dimensions of exchange rate- real and nominal exchange rate. Real exchange rate is an expression of a basket of goods in a country that can be exchanged for a basket of goods in another. It is the actual measure of prices of imported and exported goods (Latief and Lefen, 2018), while nominal exchange rate is represented in the earlier definition of exchange rate.

Regime: Floating or Fixed, Flexible or Pegged

To manage exchange rate fixed or floating exchange rate policy can be adopted. Irrespective of the policy adopted, the debate on which supports growth and economic output better rages on (Olofsson, 2019), there is however a

preponderance of theoretical evidence that exchange rate stability supports economic growth and manufacturing sector output. In furtherance of the debate, proponents of flexible/floating exchange rate policy argue that in episodes of asymmetric real shocks with relatively stable and fixated prices and wages, flexible exchange rates can be moderate the relative international prices, thus eliminate production losses (Mundell, 1961). It is further advanced that floating exchange rate volatility provide greater adaptive capacity. Beyond these, floating exchange rate affords the monetary authorities and indeed the financial system a environment of monetary policy autonomy.

Nevertheless, the potential benefits of exchange rate flexibility (especially as regards autonomy) should be juxtaposed with the cost of unpredictable fluctuations especially in shallow financial systems that lack adequate hedging avenues. Thus the purveyors of the fixed exchange rate policy allude that pegging the exchange rate while stabilizing the nominal exchange rate with the instrumentality of money supply is good enough (Olfsson, 2019). This is argued to be a more potent instrument in curtailing volatility (Romer, 2012).

Effect: Neutral, Positive or Negative

Theorists theorise that exchange rate volatility can have a positive or negative effect on the economy in general and manufacturing in particular (Backman, 2006). This is at abeyance with the argument of Baron (1976) that manufacturing firms have the capacity to plan production using forward exchange rates, thereby act as profit maximisers by utilizing the marginal profit as a planning buffer or equivalent, though the entire exchange rate exposure might not be saved. Consequently, the firm is indifferent to the volatility. This position is however utopian from the perspective of the Nigerian financial system that lacks depth to appreciably predict and utilize instruments from the derivatives market to cushion exchange rate exposures. Thus, more often than not, the impact is adverse as the conditions that promote adverse effect of exchange rate volatility on economic agents are ominous and copious.

There is negative effect on corporations since most capital goods are internationally sourced. This adverse effect is not eliminated by the existence of derivatives market as forward/futures market cannot totally absorb this effect that emanate due to cost implications, risk premium, poorly developed futures/forward markets across a wide spectrum of maturities, failure to completely absorbs the exposure even in well developed markets, etc. exchange

rate volatility in itself heightens uncertainty which increases risk and curtails production. This is more evident where it is improbable to construct a perfect hedge, and firms are risk averse. Exchange rate volatility also present manufacturing firms with opportunities as they could potentially have increase export as comparative advantages become more attractive.

Exchange Rate Volatility: Measures

Three prominent methods are used in the estimation of exchange rate volatility. These are the standard deviation method (Nishimura and Hirayama, 2013), the moving average method (Hall, Hondroyiannis, Swamy, Tavlas, and Ulan, 2010) and the Generalised Autoregressive Conditional Heteroskedasticity (GARCH) (Sharma and Pal, 2018). The first and second approaches have inherent estimation bias and accommodate the stochastic elements, thereby lacking the potential of capturing the effect of large variance experienced in lagged periods, which is essential in estimating future volatility (Barguellil, et al, 2018). On the contrary, GARCH models are more adopted as they are superior in estimating volatility by incorporating time-varying conditional variance (Sharma and Pal, 2018).

Empirical Review

Several studies that relate to exchange rate volatility have been conducted locally and internationally. These include Ndidi and Ogedengbe (2019) who sought to examine how exchange rate volatility affects the non-oil sector of Nigeria's economy by applying an array of econometric analyses to find a negatively significant effect of exchange rate volatility on the non-oil sector. Similarly, Oseni, et al, (2019) investigated exchange rate volatility and industrial output growth in Nigeria to test the neoclassical theoretical postulation that exchange risk culminates in economic growth. The trio applied the AR(k)-EGARCH models to show that exchange rate volatility determines industrial production and contributes tremendously to industrial production. In contrast, Aidi, et al (2017) used quarterly data from 1980 to 2016 which was analysed by utilising OLS and EGARCH to show that exchange rate volatility is inversely related to industrial sector performance in Nigeria.

It is further seen in the work of Ayobami (2019) that there is a positive and significant short and long run relationships between exchange rate volatility and manufacturing sector performance in Nigeria. This follows the application of ARDL among other analytical techniques on relevant data sourced from the

Worldbank and Statistical Bulletin of the Central Bank of Nigeria (CBN) for the period 1981 to 2016. However, while relating this investigation to the Ghanaian economy, Alagidede and Ibrahim (2016) observed that exchange rate volatility is detrimental to economic growth in an environment where innovation and more efficient resource allocation is jettisoned. To elaborate this finding, they emphasised that while shocks to the exchange rate are mean reverting, misalignments tend to correct slowly with catastrophic consequences in the short run as economic agents recalibrate their consumption and investment choices.

Given that trade in general, and export in particular is a function of industrial production and manufacturing, Backman (2006) examined how exchange rate volatility impacts Swedish exports. The researcher used Sweden and Euro zone data from 1993 to 2006 and used the ordinary least square regression technique to analyse the data which shows no concrete empirical evidence that exports are influenced by exchange rate volatility. In the same vein, Sugiharti, et al (2020) replicated the exchange rate volatility – exports study in Indonesia by using the GARCH, ARDL and NARDL to analyse relevant monthly data from 2006 to 2018 to show that exchange rate volatility has a significant effect on exports certain products – ores, chemicals, rubber and pulp in the short and long runs. This effect is also seen to be negative in most exported goods.

On the other hand, Barguellil, et al. (2018) empirically considered exchange rate volatility and economic growth in a cross-national study which involved 45 countries by utilisingthe GARCH technique to provide evidence of a negative effect of exchange rate volatility on economic growth. In that same light, Umaru, et al (2018) narrowed the study of exchange rate volatility and economic growth to English- speaking West-African countries to show that there is a significant negative relationship between exchange rate volatility and economic growth.

METHODOLOGY

In further estimating the influence of exchange rate volatility on manufacturing sector performance in Nigeria over the period of study (1982 to 2019), data that relate to manufacturing sector gross domestic product (MGDP), official exchange rate (OFEX) and Parallel market exchange rate (PLEX) were sourced from the CBN statistical bulletin. These data were converted from their natural state to rates (%) so as to establish uniformity among them. They were subsequently analysed using the OLS, Pairwise Granger Causality and GARCH

models.

The OLS model is deterministic built on the premise that manufacturing sector's output is dependent on exchange rate which is stated thus:

$$MGDP_t = f(EXR_t) \qquad (1)$$

But as earlier expressed, manufacturers are not limited to the official foreign exchange window, in fact the parallel market is more active and accessible to manufacturers, therefore manufacturers are active in the official and parallel markets, hence the expression is broadened:

$$MGDPt = f(OFEX_t, PLEX_t) \qquad (2)$$

Where:

MGDP = Manufacturing sector contribution to gross domestic product
MGDPR = Manufacturing sector contribution to gross domestic product rate
OFEX = Official Exchange Rate
PLEX = Parallel Exchange Rate (BDC)
EXR   = Exchange Rate

GARCH MODEL

Exchange rate volatility is measured by applying the simple process and model described by Hull and Basu (2016). This is inputted into the simplest form of GARCH model (1,1) as follows:

$$R_t = b_0 + b_1 R_{t=1} \qquad \text{...........(1)}$$
$$s_t^2 = w + am_{n+1}^2 + bs_{n=1}^2 \qquad \text{..........(2)}$$
$$s_t^2 = w + am_{n+1}^2 + bs_{n=1}^2 d_{n=1+} gs_{n=1}^2 \qquad \text{...........(3)}$$

where: w is constant, a, b and g are coefficients. m_{n+1}^2 is the mean square of the previous time period. s_t^2 is the variance of the previous time period. D_n takes the value of 1 for $m_t < 0$, and 0 otherwise.

DATA ANALYSES, RESULTS AND DISCUSSION

Descriptive Statistics

In order to have a simple appreciation of the employed data especially with regard to their trends, mean, deviations, skewness and kurtosis are shown below as follows:

Table 1: Descriptive statistics

	MGDP	MGDPR	OFEX	PLEX
Mean	2715.218	8.078421	88.66263	99.38605
Median	1761.750	8.170000	97.40000	102.7650
Maximum	6684.220	11.78000	306.0800	395.7000
Minimum	1018.910	6.050000	0.610000	0.640000
Std. Dev.	1793.442	1.480310	87.19236	106.6409
Skewness	1.274875	0.271677	0.799099	1.248966
Kurtosis	3.100299	2.145429	2.964205	4.192060
Jarque-Bera	10.30954	1.623747	4.046238	12.12939
Probability	0.005772	0.444025	0.132242	0.002323
Sum	103178.3	306.9800	3369.180	3776.670
Sum Sq. Dev.	1.19E+08	81.07871	281292.8	420774.4
Observations	38	38	38	38

Source: E-views 11 output.

Table 1 shows that in naira, the manufacturing sector has contributed a total of 2715.218 billion naira to Nigeria's GDP. This is a paltry 8.08% of total output which shows that the Nigerian manufacturing sector contributes less than 10% of its overall output. This shows a shallow manufacturing prowess. In terms of the exchange rate, the average official exchange rate (OFEX) is averaged at 88.66 naira to a dollar, while the parallel (BDC) rate is averaged at 99.38605 naira to a single unit of dollar. All variables show positive skewness. This shows that, in terms of the exchange rate, the naira has been having a free fall when compared to the USD ($). This is most noticeable as the exchange rate has continually grown in value (depreciated) in terms of the dollar.

Empirical Results

The multiple regressions (OLS) result is presented in the table 2 to show the short run relationship among employed variables.

Table 2   Ordinary Least Square Output

Dependent Variable: MGDP
Method: Least Squares
Date: 15/06/20   Time: 11:47
Sample: 1982 2019
Included observations: 38

Variable	Coefficient	Std. Error	t-Statistic	Prob.
C	8.651992	0.324766	26.64070	0.0000
OFEX	-0.050939	0.015748	-3.234577	0.0027
PLEX	0.039678	0.012876	3.081530	0.0040
R-squared	0.738430	Mean dependent var		8.079092
Adjusted R-squared	0.694912	S.D. dependent var		1.480174
S.E. of regression	1.328112	Akaike info criterion		3.481050
Sum squared resid	61.73581	Schwarz criterion		3.610333
Log likelihood	-63.13995	Hannan-Quinn criter.		3.527048
F-statistic	5.478842	Durbin-Watson stat		2.190600
Prob(F-statistic)	0.008510			

Source: Extracted from Eviews-11.

Official exchange rate (OFEX) shows a negative coefficient of -0.050939. This shows that, if all factors are kept at a constant, a unit increase in official exchange rate will lead a 0.050939 decrease in manufacturing sector output rate. This shows that when the naira appreciates, the output of the manufacturing sector usually wanes/dwindles. On the other hand, Parallel Exchange Rate (BDC) shows a positive coefficient of 0.039678. This connotes that, if all factors are kept at a constant, a unit increase in the parallel exchange rate (BDC) will lead to a 0.039678 unit increase in manufacturing sector output. This shows that, when parallel/black market rates depreciate, the demand for foreign currencies might be bolstering the output of the manufacturing sector.

From the above result, it revealed that all the explanatory variables have mixed short-run relationship and influence on manufacturing sector performance (Manufacturing sector contribution to Gross Domestic Product) in Nigeria.

However, exchange rate volatility is seen to have a statistically significant relationship with manufacturing sector's output.

Granger Causality Test

To establish the causal relationship among the variables, the Granger causality test was used to show as follows:

Table 3: Pairwise Granger Causality Test

Pairwise Granger Causality Tests
Date: 15/06/20   Time: 13:18
Sample: 1982 2019
Lags: 2

Null Hypothesis:	Obs	F-Statistic	Prob.
OFEX does not Granger Cause MGDP	36	3.75593	0.0478
MGDP does not Granger Cause OFEX		0.75485	0.4785
PLEX does not Granger Cause MGDP	36	3.62711	0.0491
MGDP does not Granger Cause PLEX		0.26652	0.7678
PLEX does not Granger Cause OFEX	36	3.80615	0.0333
OFEX does not Granger Cause PLEX		2.06192	0.1443

Source: Extracted from Eviews-11

Using the 0.05 (5%) significance level as the threshold for significance, the Table shows that:
- No bidirectional causal relationship exists in the above table.
- There is unidirectional causal relationship spilling from:
- Official exchange rate OFEX to MGDP based on the probability value of 0.0478 which is less than the 0.05 (5%) significance level.
- Parallel Exchange Rate BDC to MGDP based on the probability value of 0.0491 which is less than the 0.05 (5%) significance level.

Generalized Autoregressive Conditional Heteroskedasticity (GARCH)

The GARCH analysis output is presented in table 4.

Table 4: GARCH output

Dependent Variable: MGDP
Method: ML ARCH - Normal distribution (BFGS / Marquardt steps)
Date: 15/06/20   Time: 11:50
Sample: 1982 2019
Included observations: 38
Convergence achieved after 42 iterations
Coefficient covariance computed using outer product of gradients
Presample variance: backcast (parameter = 0.7)
GARCH = C(4) + C(5)*RESID(-1)^2 + C(6)*GARCH(-1)

Variable	Coefficient	Std. Error	z-Statistic	Prob.
C	8.546759	0.227121	37.63085	0.0000
OFEX	-0.045039	0.023664	-1.903277	0.0570
PLEX	0.025436	0.021839	1.164681	0.2441
Variance Equation				
C	0.011927	0.023676	0.503759	0.6144
RESID(-1)^2	1.568596	0.754613	2.078676	0.0376
GARCH(-1)	0.087471	0.097955	0.892973	0.3719
R-squared	-0.697587	Mean dependent var		8.079092
Adjusted R-squared	-0.794592	S.D. dependent var		1.480174
S.E. of regression	1.982876	Akaike info criterion		3.163284
Sum squared resid	137.6129	Schwarz criterion		3.421850
Log likelihood	-54.10239	Hannan-Quinn criter.		3.255279
Durbin-Watson stat	0.252057			

Source: Extracted from Eviews-11

The output above in table 4 shows the evidence of volatility in the employed model. The RESID(-1)^2 which represents the volatility variable can be observed to display a probability value of 0.0376. This shows the evidence of volatility in the exchange rates (official and parallel) and manufacturing sector output. While the GARCH(-1) which shows the spill-over of this volatility shows

a probability value of 0.3719 which is greater than the 0.05 (5%) significance level. This therefore shows the absence of spill-over.

This means that, despite the evidence of volatility in the employed variables, there is no spill-over effect of the volatility. This means that variation in exchange rate does not necessarily transmit to the manufacturing sector.

The study revealed that Official exchange rate (OFEX) shows a negative and insignificant influence on manufacturing sector contribution to Gross Domestic Product in Nigeria. This shows that depreciation in the official exchange rate (OFEX) is likely to stimulate the level of contribution of the manufacturing sector to gross domestic product and promote productive activities in the Nigerian economy, albeit insignificantly. This is in consonance with the Aidi, et al (2017), while it negates the findings of Oseni, et al (2019) and Ayobami (2019) who observe negative relationship between both variables. Parallel Exchange Rate on the other hand, shows a positive and insignificant influence on manufacturing sector contribution to Gross Domestic Product in Nigeria. This shows that, as Parallel Exchange Rate depreciates, the level of manufacturing sector performance grows. This could be linked to the misappropriation of these foreign exchange allocations to other sectors such as oil servicing firms.

This study supports the view of Ogunmuyiwa and Ekone (2010) who observed insignificant influence of Exchange Rate dimensions on sectoral performance in Nigeria. The study nonetheless goes against the study of Onyeiwu (2012), Babatunde and Shuaibu (2011) that the Exchange Rate has significant impact on the sectoral performance in Nigeria.

CONCLUSION AND RECOMMENDATIONS

The study therefore concludes that, there is no significant relationship between Official Exchange Rate volatility and Nigeria's manufacturing sector output. This is replicated in the relationship between parallel exchange rate and manufacturing sector's economic output. However, is foreign exchange (i.e. the aggregation of official and parallel windows) significantly affects contribution of the Nigeria's manufacturing sector to the GDP.

It can thus be deduced that despite the corrective potential imbedded in the foreign exchange market in light of the manufacturing sector performance. The foreign exchange still fails in stimulating the performance of this important

sector. This invariably shows misallocation of foreign exchange to other classified sector and that efforts towards curtailing output in the country might not be achieving its expected outcome, despite its potentials. Overall, the volatility in the foreign exchange market does not significantly affect the manufacturing sector.

Based on the study's findings, it is therefore important to consider policies that would ensure sustained growth in Nigeria.

i) Activities of the parallel market via the bureau De change (BDC) should be curtailed to ensure that foreign exchange sectoral allocation and mobilization is adhered to.

ii) Official foreign exchange market should be made accessible to the manufacturing sector.

iii) Policy makers should fashion out appropriate policies that will enhance the provision of enabling environment for the growth and development of the manufacturing sector in general in order improve its contribution to the nation's performance.

iv) There should be effective management of interest rate and exchange rate in Nigeria so as to encourage the stock Market.

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