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Exchange Rate Volatility and Manufacturing Sector Exports in Nigeria

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Abstract

This study examined the impact of exchange rate volatility on the manufacturing sector export in Nigeria. Data for the study were sourced from the Central Bank of Nigeria Statistical Bulletin and the National Bureau of Statistics over the period 1980 to 2021. The study used the Autoregressive Distributed Lag Model and examined the long run and short run effects of exchange rate volatility on the performance of the manufacturing sector export in Nigeria. The estimated results revealed that exchange rate volatility had positive and statistically significant impact on manufacturing sector export in Nigeria in the long run. Based on the findings of this study, it was concluded that exchange rate volatility had significant impact on manufacturing sector export in Nigeria. The study therefore recommended among others that the government and policy makers should evolve policies that stabilize the naira by reducing or totally removing the arbitrage between the parallel markets and the official markets. More so, the study also recommended that manufacturers who rely heavily on imported raw materials that cannot be easily sourced locally should be made to access the exchange rate at the official rate with ease in order to increase the manufacturing sector output for export.

Keywords: *Exchange Rate, Volatility, Manufacturing sector, Export, Nigeria*

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Background to the Study

The Nigerian government has prioritized diversifying the economy beyond its dependence on oil exports. The manufacturing sector plays a crucial role in this strategy, with the potential to create jobs, generate foreign exchange, and stimulate economic growth. However, achieving this goal requires addressing significant challenges. One key obstacle is the volatility of the exchange rate, which creates uncertainty for businesses and hinders export competitiveness. Exchange rate is a significant macroeconomic variable because its depreciation or appreciation has negative or positive repercussions on all the sectors of the economy especially the manufacturing sector (Odili, 2014; Aizenman & Marion, 1999). Through international trade among countries, economies have experienced periods of exchange rate fluctuations, slower growth among others (Todaro & Smith, 2008) and this has exposed many developing countries to periods of imbalances. Exchange rate fluctuations do not only affect economic growth but also the performance of firms. For instance, exchange rate depreciation increases the cost of imported capital goods for manufacturing firms and this result to a fall in domestic investment among others.

Nigeria's economy has historically been heavily dependent on oil exports, which constitute a substantial portion of government revenue and foreign exchange earnings. This dependency has exposed the economy to global oil price fluctuations, which, in turn, have significantly influenced the exchange rate of the Naira. Periods of high oil prices typically lead to an appreciation of the Naira, while oil price crashes result in depreciation. This volatility has profound implications for other sectors of the economy, particularly manufacturing. Since the mid-1980s, Nigeria has undergone various economic reforms aimed at liberalizing the economy and improving its global competitiveness. Key among these reforms was the Structural Adjustment Program (SAP) of 1986, which aimed to diversify the economy away from oil dependence, deregulate the exchange rate, and promote non-oil exports. Despite these efforts, the exchange rate regime has oscillated between fixed, floating, and managed float systems, contributing to exchange rate instability. The Central Bank of Nigeria (CBN) also has implemented several measures to manage exchange rate volatility, including interventions in the foreign exchange market, adjusting interest rates, and maintaining foreign exchange reserves. However, these measures have met with varying degrees of success, and exchange rate volatility remains a persistent challenge.

Despite the recognized importance of exchange rate stability for economic development, the Nigerian economy has witnessed periods of pronounced volatility, characterized by sharp fluctuations in the value of the naira against major currencies such as the US dollar, euro, and pound sterling. For instance, the naira has kept on depreciating from N 0.54 in 1980 to N 2.02 in 1986, and N7.901 in 1990, all against the one US dollar. The policy of deregulation pegged the naira at N21.886 in 1994, N 86.322 in 1999 and N135.50 in 2004. Thereafter, the exchange rate appreciated to N132.15 in 2005 and N 150.00 in 2009. In 2015 the exchange rate of a US dollar to naira is N165. But after the 2015 general election and the swearing-in of President Muhammadu Buhari, the rate of exchange of Nigeria naira to the United States Dollar has been alarming. For instance, in October 2016, the exchange rate of one US dollar to naira in the parallel market is N 500.00 (George-Anokwuru, Obayori & Oriji, 2018). Similarly, the

naira has depreciated against the U.S dollar by more than 113% by the end of 2013 and at the end of 2018 about N363 was exchanged for one U.S dollar; reaching its peak in 2023 and 2024 at N786 and N1,450 respectively exchanged to one U.S dollar (Gbosi, 2024). Thus, the weak value of the naira to the US dollar distorted the growth of the economy and the manufacturing sector in particular.

These fluctuations have been exacerbated by factors such as fiscal imbalances, external debt pressures, inconsistent monetary policies, speculative activities in the foreign exchange market, and limited forex reserves (Stancik, 2007). Each of these factors has varying degrees of influence, depending on the economic situation of the nation in question. Thus, transitioning nations (like Nigeria) are more susceptible to these elements' effects, which in turn have an impact on monetary policy decisions. Existing research has explored the relationship between exchange rate volatility and manufacturing export in Nigeria (e.g. Umaru, Olutope, David, Annette, Daniel, Yakubu, Amechi & Uyu, 2023; Olufayo & Fagite, 2014; Ndidi & Alaba, 2019; Ishimwe & Ngalawa, 2015). These studies have employed various econometric techniques to analyze the data. However, these studies have yielded mixed findings, reflecting the complex and multifaceted nature of the relationship between exchange rates and manufacturing sector dynamics. This study aims to bridge this gap by analyzing the impact of exchange rate volatility on the manufacturing sector export in Nigeria. By employing an (Autoregressive Distributed Lag Model), we will investigate the impact of exchange rate volatility on manufacturing sector export in Nigeria. The findings will contribute valuable insights for policymakers and industry stakeholders in developing strategies to mitigate the negative impacts of exchange rate volatility and foster the growth of Nigeria's manufacturing exports.

Given the dependence of manufacturing sector on import for intermediate and capital goods, there is need to examine the manner and extent through which fluctuation in exchange rate affects the performance of manufacturing sector export in Nigeria. The study is of particular relevance because a vibrant manufacturing sector is a sinequa-non for sustained economic growth and development in any economy. In addition, the study is of great importance to the Nigeria economy given her quest to diversify the nation's economy base away from crude oil. Furthermore, this study has become necessary given the declining economic growth forcast for Nigeria in recent times as real GDP declined by 4% from 2019 in 2020, and from 3.6% in 2021 to 3.3% in 2022 (AfDB,2023). It is believed that increase in manufacturing output will lead to increase in manufacturing sector export, employment and household disposable incomes, which will stimulate increase in demand for additional goods and services, which could lead to increased capacity utilization within the manufacturing sector, and more cheaper goods leveraging on economies of scale, and finally result in overall improvement in the welfare of the populace and stimulate economic growth. The broad objective of this study is to investigate the impact of exchange rate volatility on manufacturing sector export in Nigeria.

Literature Review

Conceptual Review

Exchange Rate

Exchange rate has been defined as the price of one currency in terms of another (Mordi, 2006). Fahrettin (2001) asserts that an exchange rate, as a price of one country's currency in terms of another's, is among the most important prices in an open economy. It influences the flow of goods, services, and capital in a country, and exerts strong pressure on the balance of payments, inflation and other macroeconomic variables. Therefore, the choice and management of an exchange rate regime is a critical aspect of economic management to safeguard competitiveness, macroeconomic stability, and growth

According to O'Sullivan and Sheffrin (2003), exchange rate refers to the rate at which one currency is exchanged for another. Campbell (2010) conceptualizes the exchange rate as the price of one currency in terms of another. Exchange rate could either be nominal or real. The exchange rate of a country is either fixed or floating (Bhawna, 2012). A floating exchange rate refers to an exchange rate regime in which the market forces dictate movements in the exchange rate. On the other hand, a fixed/pegged exchange rate is an exchange rate regime in which the government through the central bank ties or fixed the value of the currency to other currencies (Eduardo & Sturzeneggar, 2003).

Aliyu (2011) noted that an appreciation of the exchange rate results in increased imports and reduced export while depreciation would expand export and discourage import. In addition, depreciation of exchange rate tends to cause a shift from foreign goods to domestic goods. Hence, it leads to a diversion of income from importing countries to countries exporting through a shift in terms of trade, and this tends to have impact on the exporting and importing countries' economic balance of payments. Exchange rate plays a key role in international economic transactions because no nation can remain in autarky due to varying factor endowment (Oladipupo & Ogheneov, 2011). Movements in the exchange rate have ripple effects on some of economic variables such as interest rate, inflation rate, unemployment, money supply; economic growth, balance of payment etc. These facts underscore the importance of exchange rate to the economic well-being of every country that opens to international trade in goods and services. Therefore, nations in the pursuit of the macroeconomic goals of healthy internal and external stability of her economy, find it imperative to adopt effective and efficient exchange rate policy.

Furthermore, Hassan (2002) agreed that exchange rate helps to connect the price systems of two different countries by making it possible for international trade and also effects on the volume of imports and exports, as well as country's balance of payments position. AZeeZ, Kolapo and Ajayi, (2012) noted that when there is deviation of this rate over a period of time from the benchmark or equilibrium, exchange rate is called exchange rate volatility. It also indicates that misalignment of exchange rate as occurred where there is multiplicity of markets parallel with the official market.

Arising from the various conceptualizations of exchange rate above, this study conceptualizes exchange rate as the price at which the currency of one country is given in exchange for that of another currency or can be converted to the currency of another country. It is the price of one country's currency expressed in terms of or in relation to some other currencies. It expresses a national currency's quotation with respect to foreign ones.

Exchange Rate Volatility

Volatility of exchange rate has been variously referred to as exchange rate fluctuation or variability. For instance, Agubata and Odubuasi (2018) saw it as "fluctuation in exchange rate" and defined it to entail the volatility and variability in the rate of exchange that affects either positively or negatively the performance of other economic variables. Jongbo (2014) equated it to "erratic fluctuations in exchange rates" and take it to mean periods of domestic currency appreciation or depreciation in an economy. Iyeli and Utting (2017) stated that exchange rate volatility is when there is deviation of exchange rate from the benchmark or equilibrium over a period of time. Adding that, it also indicates misalignment of exchange rate as the case where there exists multiplicity of parallel markets to the official market.

Ozturk (2006) considered exchange rate volatility as the risk associated with unexpected movement in exchange rate. In other words, exchange rate volatility is the risk associated with currency depreciation or appreciation. It is associated factors that induce uncertainty and risk in investment decision with destabilizing impact on the macroeconomic performance (Iyeli and Utting, 2017; Ayobami, 2019). These show unpredicted oscillatory movements that characterize rate at which one currency (in this case, Naira) exchanges for other currencies like dollar. Exchange rate volatility refers to the degree to which the exchange rate of a country changes over time. The larger the magnitude of the change in exchange rate the more volatile it is. Floating exchange rates are free to change over time and hence more volatile but fixed exchange rates are less volatile because they can only be devalued or revalued by the monetary authority of a country (Steven, 1997). For the purpose of this study however, exchange rate volatility refers to the frequency at which the naira appreciates or depreciates against the U.S dollar.

Manufacturing Sector

Manufacturing sector refers to the numerous industries which are involved in the production/manufacturing and processing of items and indulge in either creation of new commodities or in value addition (Adebayo, 2010). To Dickson (2010), manufacturing sector accounts for a significant share of the industrial sector in developed countries. The final products can either serve as finished goods for sale to customers or as intermediate goods used in the production process. According to Loto (2012), manufacturing sector refers to an avenue for increasing productivity in relation to import replacement and export expansion, creating foreign exchange earning capacity, raising employment and per capita income which causes unrepeatable consumption pattern. Mbelede (2012) opined that manufacturing sector is involved in the process of adding value to raw materials by turning them into products.

Therefore, manufacturing is the key sector in an economy and it involves the conversion of raw material into finished goods. In the opinion of Charles (2012), manufacturing industries creates employment and also boost agriculture, thus diversifying the economy by making the nation to increase its foreign exchange earnings. Manufacturing industries came into being with the occurrence of technological and socio-economic transformations in the Western countries in the 18th-19th centuries. This period was widely known as industrial revolution. It all began in Britain and replaced the labour intensive textile production with mechanization and use of fuels. Manufacturing sector is categorized into engineering sector, construction sector, electronics sector, chemical sector, energy sector, textile sector, food and beverage sector, metalworking sector, plastic sector, transport and telecommunication sector.

Theoretical Review

The Mundel-Fleming Model

The Mundell–Fleming model, also known as the IS-LM-BoP model was first developed by Robert Mundell and Marcus Fleming in the early 1960s. The model is an extension of the IS–LM model. The Mundell–Fleming model describes the short-run relationship between an open economy's nominal exchange rate, interest rate, and output (in contrast to the closed-economy IS-LM model, which focuses only on the relationship between the interest rate and output). The Mundell–Fleming model has been used to argue that an economy cannot simultaneously maintain a fixed exchange rate, free capital movement, and an independent monetary policy. An economy can only maintain two of the three at the same time. This principle is frequently called the impossible trinity or the Mundell–Fleming trilemma. The model shows that the effectiveness of national macroeconomic policy depends on the exchange rate system. This is because in open economy the real exchange rate influence net export and thus income and output. However, the Mundell-Fleming model works with the assumption that prices are fixed. This means that the aggregate supply curve is flat (horizontal in the extreme) and income is determined by the aggregate demand only.

In the Mundell–Fleming model, the demand side of the economy consists of LM and IS equations as follows:

$$M/P = m(Y, I, Q, e^{md}) \quad (1)$$

$$Q = q(Y, I^*, e^{sb}) \quad (2)$$

Where M is money stock, P is the price level, Y is real output, which is the same as real income in the equilibrium, I is the nominal interest rate, Q is real exchange rate (defined as $S.P^*/P$), S is the nominal exchange rate in naira/US$, the asterisk (*) denotes foreign (the world) variable, e^{md} is a shock to money demand, and e^{sb} denotes a shock to spending balance. *Equation (1)* is the money demand, in which it is generally accepted that money demand is affected by real output positively ($m_Y > 0$) and by nominal domestic interest rate negatively ($m_I < 0$). Moreover, a real depreciation in domestic currency (an increase in Q) would lead to a decrease in the real money holding ($m_Q < 0$). It is also asserted that M/P fluctuations are driven by exogenous shocks to money demand.

Equation (2) is the IS function expressed in terms of the real exchange rate. Output and the real exchange rate could be related in a positive or negative manner (Siregar & Ward, 2000). The direction of this relationship depends on sources of changes in output. An increase in Y could, for example, originate from an increase in investment or from an increase in net exports. Through the former the increased investment leads to a rise in interest rates, which would be followed by an exchange rate appreciation, implying that $q_Y < 0$. Through the latter the increase in net exports would have required the real exchange rate to depreciate, implying that $q_Y > 0$. Furthermore, an increase in the world interest rate reduces investment, leading to an excess supply of the domestic currency (naira), hence causing the real exchange rate to depreciate, i.e., $q_I^* > 0$. Finally, Q is also assumed to be driven by general shocks to spending balance (e^{sb}). These shocks may include unanticipated fiscal policies, which, if contractionary, would lead to real exchange rate depreciation.

The Mundell-Fleming model is significant to this study because of how it explains the behaviour of the exchange rate. In Nigeria, the value of the Naira has fluctuated a great deal over the years. Understanding why exchange rate fluctuates and how the fluctuations affect manufacturing sector performance would help the authorities in their efforts to stabilize the exchange rate.

The Clark Model of Exchange Rate Volatility

The Clark Model of exchange rate volatility was developed by Clark in 1973. The model shows an inverse relationship between exchange rate volatility and trade flows. According to Clark (1973), the uncertainty associated with exchange rate volatility would adversely affect profit, output and hence exports of the manufacturing sector. The simplest case described by Clark (1973), for example, considers a competitive firm with no market power producing only one commodity which is sold entirely to one foreign market and does not import any intermediate inputs. The firm is paid in foreign currency and converts the proceeds of its exports at the current exchange rate, which varies in an unpredictable fashion, as there are assumed to be no hedging possibilities, such as forward sales of the foreign currency export sales. Moreover, because of costs in adjusting the scale of production, the firm makes its production decision in advance of the realization of the exchange rate and therefore cannot alter its output in response to favorable or unfavorable shifts in the profitability of its exports arising from movements in the exchange rate. In this situation, the variability in the firm's profits arises from the exchange rate, and where managers of the firm are adversely affected by the risk, greater volatility in the exchange rate with no change in its average level leads to a reduction in output, and hence in exports in order to reduce the exposure to risk. This conclusion rests on the simplifying assumption that there are no hedging possibilities either through foreign exchange market or through off setting transactions. For advanced economies where their well-developed forward exchange markets, specific transactions can be easily hedged, thus reducing exposure to unforeseen movements in exchange rates. However, there is need to recognize that such markets do not exist for the currencies of most developing countries (Clark, Tamirisa & Wei, 2004).

This theory is relevant to this study because, it emphasizes the importance of exchange rate considerations in the decision making of firms. That is, the decision to produce or not depends to a large extent on the stability of the exchange rate. A stable exchange rate reduces the risks level and builds investors' confidence in investing in the manufacturing sector. Therefore, the manufacturing sector export is greatly influenced by the stability of the exchange rate as espoused by the Clark model of exchange rate.

Empirical Review

Akinlo and Adejumo (2014) investigated the impact of exchange rate volatility on non-oil exports in Nigeria. The authors employed the Error Correction model and quarterly data from 1986(1) to 2008(4). Finding from the study revealed that exchange rate volatility has positive and significant effects on non-oil exports in the long run while the short run impact of the exchange rate volatility is not significant.

Rasaki and Oyedepo (2023) assessed the symmetric and asymmetric effects of exchange rate volatility on trade flows in Nigeria. The study employs quarterly data and covers the period 1995q1 to 2020q4. The data were sourced from International Financial Statistics (IFS) and Central Bank of Nigeria (CBN) websites. The study employed both linear ARDL and non-linear ARDL (NARDL) models to evaluate the symmetric and asymmetric effects of exchange rate volatility. The findings of the study revealed that exchange rate volatility has only significant short-run effect on export while it has both short-run and long run effects on the imports. The findings from the non-linear ARDL suggest that exchange rate volatility has neither short run nor long run asymmetric effects on exports. However, the non-linear ARDL model revealed short run and long run asymmetric effects of exchange rate volatility on imports. The findings show that increase in volatility reduces imports while decrease in volatility boosts imports.

Umaru, Olutope, David, Annette, Daniel, Yakubu, Amechi and Uyu (2023) examined the impact of exchange rate volatility on export in Nigeria. The study employed the ARDL-Error Correction Model and Bound Test using secondary data sourced from the Statistics Database of the Central Bank of Nigeria. The empirical finding revealed that exchange rate volatility has negative significant impact on export in Nigeria. Olufayo and Fagite (2014) investigated the impact of exchange rate volatility on the performance of Nigeria export sectors from 1980 to 2011. The study employed the GARCH (generalized autoregressive conditional heteroskedasticity and Seemingly Unrelated Regression (SUR). The results revealed a negative relationship between the volatility of exchange rate and export performance of oil and non-oil sectors. Another finding from their study was that the introduction of floating exchange rate system in Nigeria induces instability in the country exchange rate. Their finding is consistent with previous studies that the shift from fixed exchange rate to floating exchange rate brought about uncertainty in the exchange rate.

Equally, Vo, Vo and Zhang (2019) analyzed the effect of exchange rate volatility on disaggregated manufacturing exports with evidence from an emerging country. The aim was to analyze the link between exchange rate devaluation, volatility, and manufacturing export

performance. The analysis focuses on the manufacturing sector and 10 of its subsectors that were engaged in the export of goods between Vietnam and 26 key export partners during the 2000–2015 period. Potential factors that could affect this relationship, such as the global financial crisis, Vietnam's participation in the World Trade Organization, or even the export partners' geographic structures, were also accounted for in the model. The findings confirmed that a strategy that depreciates Vietnam's currency appears to enhance manufacturing exports in the short run, whereas the resulting exchange rate volatility has clear negative effects in the long run. The impact of exchange rate volatility on manufacturing subsectors was found to depend on two factors, namely, (i) the type of export and (ii) the export destination.

Aminu, Bello and Salihu (2013) investigated the impact of exchange rate volatility on export in Nigeria. The paper employed three models, viz: Ordinary Least Square (OLS); Granger causality test; and ARCH and GARCH techniques and also Augmented Dickey-Fuller technique was used in testing the presence of unit root. The results of unit root suggested that all the variables in the model are stationary at first difference, while causality test revealed that there is causation between export and exchange rate in the country, but the causation flows from exchange rate to export. Thus, exchange rate causes export. Furthermore, ARCH and GARCH results suggested that the exchange rate is volatile nevertheless export is found to be non-volatile. The study further showed that exchange rate is impacting positively on export, as shown by the regression results. The elasticity results revealed that, the demand for Nigerian products in the World market is fairly elastic. Therefore, for export to improve and foreign exchange earnings increase, the country should depreciate its currency, thereby reducing the price of its products so as to increase demand, which is changing from import-led to export-led economy.

Tampuri (2018) examined the effect of exchange rate movements on export sector performance in Ghana. The focus is on the real sector of the economy thus, Agricultural, Industrial and Services Sectors. A quantitative research design is employed. It uses data from the World Development Indicators (WDI) and the sample period spans1984-2016. The Generalized Autoregressive Conditional Heteroskedastic (GARCH) model is employed in calculating exchange rate volatility. This was after an ARCH effect had been established among the exports. Specifically, the GARCH (1, 1) model is employed in establishing and analyzing the dynamic interactions and long-run relationships between variables. Also, the autoregressive distributed lag co-integration technique is adopted. The study finds that, exchange rate volatility impacts negatively on export performance.

Oluyemi and Essi (2017) investigated the effect of exchange rates on imports and exports in Nigeria using monthly data from 1996 - 2015. A three variable vector auto regression (VAR) consisting of imports, exports and exchange rates (US dollar to Naira) is considered to examine the effect of exchange rate on imports and exports in Nigeria. Augmented Dickey Fuller (ADF) test is used to test the stationarity of each of the variables. The VAR result shows that exchange rates have a positive and insignificant effect on imports while it has a negative and insignificant effect on exports at lag 1 but positive and insignificant effect at lag 2. Exports were also found to affect exchange rates negatively while imports affect exchange rates

positively. The above result thus shows that exchange rate in Nigeria is not affected by the activities of imports and exports. Neither does an exchange rate affect the volume of imports and exports in Nigeria. Contrary to economic theory that a fall in the exchange rate will cause imports to fall, imports in Nigeria have been on the increase irrespective of the exchange rates. The result of the impulse response function shows that exchange rates responded positively to imports and negatively to exports.

Duru, Eze, Saleh, Uzeouchina, Ebenyi and Chukwuka (2022) investigated the impact of exchange rate volatility on exports in Nigeria utilizing data from 2005Q1 to 2020Q4. The ARCH model and its extensions of GARCH, TARCH and EGARCH models and nominal effective exchange rate were employed to measure exchange rate volatility. The Autoregressive Distributed Lag Bounds test methodology was used to examine the short-run and long-run effects of exchange rate volatility on exports. The findings validated the presence of exchange rate volatility. In addition, the results revealed that exchange rate volatility had a negative and insignificant impact on exports.

Methodology

Research Design

Based on the nature of this study, and the variables involved, this study however, employed the causal research design also called the explanatory research design.

Sources of Data

The type of data used in this study was secondary data ranging from 1980 to 2021, sourced from CBN Statistical Bulletin of various years, National Bureau of Statistics (NBS) and the World Development Indicators (WDI).

Techniques of Data Analysis

The Autoregressive Distributive Lag (ARDL) model will be used for the statistical validation of the relationship between dependent variable and independent variables.

Model Specification

To achieve the objectives of this study, the model of Ayobami (2019) was adapted for this study with modifications. The model of Ayobami (2019) which expressed manufacturing output as a function of exchange rate, exchange rate volatility, interest rate, inflation, import and gross capital formation will be modified by first dropping exchange rate variable from the model. This is because, using exchange rate and exchange rate volatility which is derived from exchange rate in the same model is most likely to lead to the problem of multicollinearity. Further, the study will incorporate government funding of manufacturing sector in the model to account for the several interventions made by the government in the time past to boost manufacturing sector export. Therefore, the mathematical/functional forms of the models for this study are stated as;

$$MANexp = f(EXRV, GFMS, INTR, IMP) \quad (1)$$

Where:

MANexp = manufacturing sector exports
EXRV = exchange rate volatility
GFMS = government funding of manufacturing sector
INTR = interest rate
IMP = manufacturing import

The stochastic or econometric specifications of equation (1), is expressed as;

$$MANexp_t = \beta_0 + \beta_1 EXRV_t + \beta_2 GFMS_t + \beta_3 INTR_t + \beta_4 IMP_t + \varepsilon_t \text{ ---------- (2)}$$

It is expected on a priori that $\beta_1 < 0; \beta_3 < 0 \; and \; \beta_4 < 0$ while $\beta_2 > 0$. This shows that increase in exchange rate volatility, interest rate and import is expected to have negative impact on manufacturing sector export in Nigeria, assume all things remain equal.

ARDL Model Specification

In order to obtain the long-run and short-run estimates of manufacturing sector export models, the study re-specifies equations 1, 2, and 3 to dynamic Autoregressive Distributed Lag (ARDL) model of Pesaran, Shin and Smith (2001) as shown in equations 3;

$$\Delta MANexp_t = \beta_0 + \beta_1 MANexp_{t-1} + \beta_2 EXRV_{t-1} + \beta_3 GFMS_{t-1} + \beta_4 INTR_{t-1} + \beta_5 IMP_{t-1}$$

$$+ \sum \beta_6 \Delta MANexp_{t-1} + \sum_{i=0}^{q} \beta_7 \Delta EXRV_{t-1} + \sum_{i=0}^{q} \beta_8 \Delta GFMS_{t-1} + \sum_{i=0}^{q} \beta_9 \Delta INTR_{t-1}$$

$$+ \sum_{i=0}^{q} \alpha_{10} \Delta IMP_{t-1} + \lambda ECM_{t-1} + \varepsilon_t \text{ ---------- (3)}$$

Results and Discussion

Descriptive Statistics and Correlation Matrix

THE summary of the descriptive statistics and correlation Matrix of the variables employed in the study is presented in Table 1.

Table 1: Descriptive Statistics and Correlation Matrix

	MANexp	EXRV	GFMS	INTR	IMP		
Panel A: Descriptive Statistics							
Mean	13.81920	3.645559	4.130820	-3.225021	13.50855		
Median	14.44035	4.731362	5.302608	1.461006	14.12166		
Maximum	16.80676	5.971262	7.005299	2.900322	16.99995		
Minimum	8.922992	-0.451143	-0.415515	-65.85715	8.696778		
Std. Dev.	2.701910	1.978333	2.380891	11.99658	2.709773		
Skewness	-0.614932	-0.811341	-0.645777	-3.937500	-0.486638		
Kurtosis	1.943469	2.441680	1.803557	19.90346	1.860804		
Jarque-Bera	4.490908	5.030728	5.295131	594.0601	3.835267		
Probability	0.105879	0.080833	0.070823	0.000000	0.146954		
Panel B: Correlation Matrix							
MANexp	0.3024	0.8366	1	0.9674	0.9586	0.3804	0.9913
EXRV	0.2856	0.7800	0.9674	1	0.9233	0.4323	0.9605
GFMS	0.2498	0.7621	0.9586	0.9233	1	0.3346	.9643
INTR	0.03700	0.3813	0.3804	0.4323	0.3346	1	0.3589
IMP	0.3795	0.8183	0.9913	0.9605	.9643	0.3589	1

Source: Author's Computation Using EViews 10.

The descriptive results revealed that except for interest rate, the standard deviation scores of the other variables were relatively minimum indicating less variations in the data spread. The result also showed that all the variables except manufacturing output with the skewness value of 0.652759 were negatively skewed. This implies that all the variables except manufacturing output were not normally distributed. More so, the values of the Kurtosis showed that all the variables except interest rate (INTR) that had 19.90346 were platykurtic, with kurtosis value less than 3. This indicated also a non-normal distribution of the series. Similarly, the p-values of the Jarque Bera statistics clearly showed that all the variables except INTR had a normal distribution. This is expected given the small variances in the variables.

None normal distribution of the series as revealed by the results of the descriptive statistics in this study was due to the fact that the study used high frequency series that has high velocity; high frequency data are usually not normally distributed due to volatility issues that are inherent with shocks variables. The non-normality of the data is however not a problem for this study given the non-usage of Ordinary Least Square (OLS). It can be deduced also from Table 1 that there was no evidence of multicollinearity among the variables used in our model. This is because there were no strongly correlated variables in the model.

Pre-Estimation Tests

This section provides the pre-tests results such as unit root and cointegration tests to examine the statistical properties (stationarity and linear combination) of the variables being examined.

Unit Root Tests

Table 2: Results of Zivot Andrews (ZA) Unit Root Test with Structural Breaks

	ZA Test @ level		***ZA Test @ first difference***	
Variable	*ZA Statistic*	*Break Point*	*ZA Statistic*	*Break Point*
MANexp	-2.1342 (2)	2001	-4.9823 (2)**	1998
EXRV	-2.1758 (2)	2005	-5.2745 (2)**	2005
GFMS	-6.1252 (2)**	2004	-7.4864 (2)**	2002
INTR	-11.0997 (2)**	2005	-6.8850 (2)**	1996
IMP	-3.2403 (2)	1993	-6.4099 (2)**	1998
Sig. Level	**Crit. Values**			
1%	-5.34		-5.34	
5%	-4.93		-4.93	
10%	-4.58		-4.58	

*Note: Values in parenthesis are the lag length of variables, ** denote rejection of null hypothesis 5% level. Reject the null hypotheses of unit root when the test statistics is greater than the critical value in absolute terms.*

In order to avoid spurious results from the estimations, stationary properties of the series used in this study were subjected to test using Zivot Andrews's unit root test approach. The Zivot-Andrews unit root result revealed that all the variables except GFMS and INTR were less than the corresponding critical value of -5.34 and -4.93(that is at 1% and 5% level of significance). Hence, we do not reject the null hypotheses of unit root at level for those variables. However, after taking the first difference, the test statistics of the ZA unit root test became greater than the corresponding critical value at 5% level of significance in absolute terms for all the variables. Hence, we reject the null hypotheses of unit root at first difference, and conclude that the series were stationary at first difference. The mixed order of integration of the variables further justified the choice of the ARDL technique in estimating the relationships.

The structural breaks were identified based on minimum t-statistics where the structural break date for GFMS was identified in 2002. The date for INTR was identified in 1996. The structural break date for IMP was identified in 1998. The period 1998 was identified as the structural break date for MANexp. The date for EXRV was identified in 2005 which coincides or mark the period when the value of naira currency was on free fall as a result of pegging and further deregulation.

Bounds Cointegration Test

Table 3: Cointegration Test using ARDL Bounds Test

ARDL Bounds Test (F-STATISTICS)		
Estimated Model	**F-statistic**	**Conclusion**
$MAN_{exp} = f(EXRV, GFMS, INTR, IMP)$	16.02719**	Cointegrated

Critical Values	**Lower Bound**	**Upper Bound**
10%	2.20	3.09
5%	5.56	3.49
1%	3.29	4.37

Source: Author's Computation Using EViews 10.

*Note: I(0) and I(1) denote lower and upper bounds of the ARDL bounds test respectively. ** & *** shows statistical significance at 5% level & 10% level, respectively.*

The table 4 indicates the outcome of the bounds co-integration test of the ARDL approach. Therefore, because F-statistic (16.02719) exceeds the critical values of the upper bounds of 3.49 at significance level. Hence, we reject the null hypothesis of no cointegration and conclude that there exists cointegration or long-run relationship among the variables.

Model Estimation

Since the variables are co-integrated, the model estimation result provides both long-run and short-run estimates. Table 4 shows the outcome of the short-run and long run form of the ARDL.

4,3,1 ARDL Short-Run and Long-Run Estimates

Table 4: Results of the Short-run and Long ARDL Estimates (Manufacturing Sector Export model)

Variable	Coefficient	Std. Error	t-Statistic	Prob.
Long Run Equation				
EXRV	0.328231	0.170829	1.921403	0.0484
GFMS	0.272924	0.106075	2.572924	0.0177
INTR	-0.010786	0.006156	-1.752069	0.0944
IMP	0.549517	0.123482	4.450188	0.0002
C	-0.018985	0.045206	-0.419961	0.6788
Short Run Equation				
D(EXRV)	-0.017777	0.110668	-0.160629	0.8739
D(EXRV(-1))	-0.375073	0.142102	-2.639466	0.0153
D(EXRV(-2))	-0.609462	0.135169	-4.508894	0.0002
D(EXRV(-3))	-0.546242	0.125350	-4.357745	0.0003
D(GFMS)	0.207361	0.060916	3.404058	0.0027
D(GFMS(-1))	-0.218259	0.071870	-3.036880	0.0063
ECM(-1)	-0.703353	0.156107	-4.505583	0.0002
Adjusted R^2	0.883908			
Diagnostics	**Statistic**	**p-value**		
Heteroscedasticity (ARCH Test)	0.419004	0.9508		
Autocorrelation (Breusch-Godfrey LM test)	0.882652	0.4300		
Normality Test	1.388139	0.4995		
Stability (CUSUM)	Stable			
Stability (CUSUMSQ)	Stable			

Note: ***, ** and * indicate significance at the 1%, 5% and 10% levels respectively.

The results from table 4 showed that EXRV, GFMS and IMP have positive and statistically significant impact on manufacturing sector exports in Nigeria in the long-run. A 1 percent increase in EXRV, GFMS and IMP led to increases in manufacturing sector exports by 0.3282% 0.2729% and 0.5495% respectively. All the three variables have p-values less than 0.1 (10%) level of significance, suggesting that they are at least statistically significant at 10% level. On the other hand, the result showed that INTR had a negative and statistically significant impact on the manufacturing sector export in Nigeria during the period under study. A 1 percent increase in INTR led to decrease in manufacturing sector exports by 0.0108% in the long-run. The negative impact of interest rate suggests that, high interest rates can discourage businesses from making long-term investments in expanding their manufacturing capabilities. If manufacturers are hesitant to invest in new equipment, technology, or facilities due to higher borrowing costs, it may limit their ability to meet the demand for exports and potentially lead to lower export volumes.

Patterning to the short-run impact, the results of the ARDL in Table 4 reported the estimates for only EXRV and GFMS implying that the estimates of the other variables are so insignificant to be captured. Evidently, the results showed that EXRV in the current period and

across lags 1-3 have negative impact on manufacturing sector exports in the short-run. However, the impact became statistically significant from lag 1-3. Focusing on lag one of EXRV, the results revealed that a 1 percent increase in exchange rate volatility led to a decrease in manufacturing sector exports by 0.3750%. Similarly, the results showed that lag one of GFMS had a negative and statistically significant impact on manufacturing sector exports in the short-run. A 1 percent increase in GFMS led to a decrease in manufacturing sector exports by 0.2183%.

The adjusted R^2 value of 0.883908 implied that, about 88.39% of the variations or changes in the manufacturing sector exports in Nigeria were explained by the independent variables. Furthermore, the Error Correction Model (-ECM (-1)) which indicates the speed of adjustment to the equilibrium in the event of disequilibrium was -0.703353 and negative and statistically significant as required. The implication of this finding is that in the event of disequilibrium, the short run disequilibrium will have a fast speed of adjustment (70%) back to equilibrium.

Diagnostic Tests

Table 5: Results of the Diagnostic Tests

Diagnostic Test	**Statistic**	**p-value**		
Heteroscedasticity (ARCH Test)	0.419004	0.9508		
Autocorrelation (Breusch-Godfrey LM test)	0.882652	0.4300		
Normality Test	1.388139	0.4995		
Stability (CUSUM)	Stable			
Stability (CUSUMSQ)	Stable			
Stability (CUSUM)	Stable			
Stability (CUSUMSQ)	Stable			

The results of the several diagnostic tests to evaluate the accuracy and dependability of the estimates showed that the model was free from heteroscedasticity since the p-values of the F-statistics was greater than 0.05. the result also shows that the model was free from the problem of serial correlation or autocorrelation since the p-values of the F-statistic is greater than 0.05. The residuals of the model were normally distributed since the p-values of the test statistic (Jaque-Bera test) was greater than 0.05. Regarding the stability of the estimates, the plots of cumulative sum of recursive residuals (CUSUM) and cumulative sum of squares of recursive residuals (CUSUMQ) for the model showed that the estimate was stable (See Figures 1 and 2). This is confirmed if the blue line falls within the 5% confidence interval shown by the red lines.

Figure 1: Cumulative sum of Recursive Residuals (CUSUM)

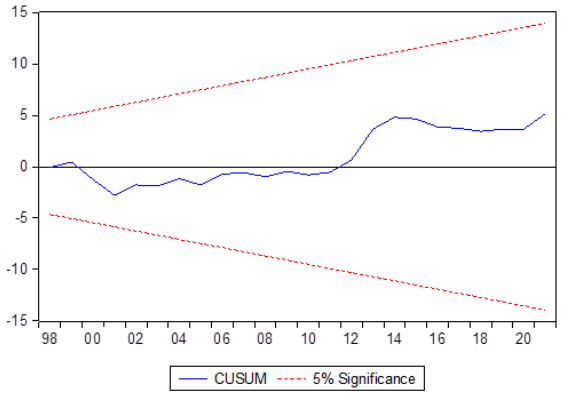
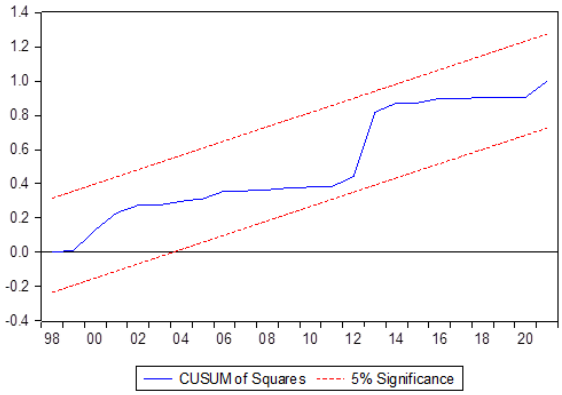
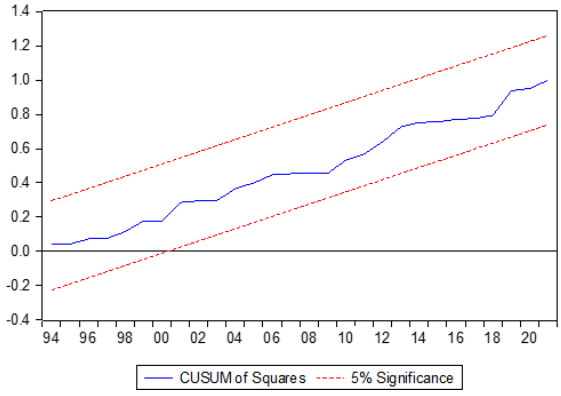


Figure 2: Cumulative sum of squares of recursive residuals (CUSUMQ)





The results of the several diagnostic tests to evaluate the accuracy and dependability of the estimates showed the following: (i) the three models were free from heteroscedasticity since

the p-values of their F-statistics were greater than 0.05. (ii) The three models were free from the problem of serial correlation or autocorrelation since the p-values of their F-statistics are greater than 0.05. (iii) The residuals of the three models were normally distributed since the p-values of their test statistic (Jaque-Bera test) were greater than 0.05. (iv) Regarding the stability of the estimates, the plots of cumulative sum of recursive residuals (CUSUM) and cumulative sum of squares of recursive residuals (CUSUMQ) for the model showed that the estimates was stable (See Figures 1 and 2). This is confirmed if the blue line falls within the 5% confidence interval shown by the red lines.

Discussions of Findings

The objective of the study was to investigate the impact of exchange rate volatility on manufacturing sector export. It was found that exchange rate volatility had positively and significant impact on manufacturing sector exports in Nigeria in the long-run. The finding conformed with theoretical expectations and agreed with the findings of Ndidi (2019), Ishimwe et al (2015), Vo et al (2019), Tampuri (2018), Olufemi and Essi (2017) and Duru et al (2012) which all showed that exchange rate volatility significantly impacts manufacturing sector exports.

This result conformed to conventional wisdom which suggests that exchange rate devaluations are typically a development strategy. Given the traded environment of the manufacturing industry, a depreciation of a currency is usually seen as a solution that remedies the poor performance of the manufacturing sector through an increase in exports. This may not be the case (as revealed by this study) if the ripple effects (imported inflation and many other problems that may come along with a weak currency) of an exchange rate depreciation are greater than the direct effects (increase in exports). For example, depreciation can cause inflation which may increase the prices of goods and services. This may hurt the manufacturing sector on the domestic market. Exchange rate volatility can influence the cost of production for manufacturers, especially those relying on imported raw materials and components. If the local currency depreciates, the cost of imported inputs increases, leading to higher production costs. This, in turn, can reduce the competitiveness of Nigerian exports in the global market. Also, exchange rate volatility introduces uncertainty for exporters, making it challenging for them to plan and forecast effectively. This uncertainty can affect strategic decision-making, including investment in export capacity and market expansion efforts. Exporters face currency risk when dealing with international transactions. Exchange rate fluctuations can lead to payment and financing risks, especially if contracts are denominated in foreign currencies. Unfavorable exchange rate movements may result in financial losses for exporters. Further, exchange rate volatility can impact the overall demand for Nigerian exports. If the local currency depreciates significantly, it may lead to reduced demand for exports as foreign buyers seek more competitively priced goods from other countries. Government responses to exchange rate volatility, such as monetary policies and interventions, can influence the competitiveness of exports. For example, if the government implements measures to stabilize the currency, it may positively impact exporters by reducing volatility.

Conclusion

The study investigated the impact of exchange rate volatitility on manufacturing export, covering the period 1981 to 2021. The exchange rate volatility series was derived using the EGARCH approach. The unit root properties of the variables were tested using the Zivot-Andrews test for stationarity. Two tests of cointegration were applied: the ARDL bounds cointegration test and the Bayer-Hanck cointegration test, and both tests confirmed cointegration among the model variables. Further, the study applied the ADRL model to investigate the long-run and short-run impact of exchange rate on manufacturing sector performance. It was discovered that exchange rate volatility had significant positive impact on manufacturing sector exports in Nigeria in the long-run. These findings suggest that exchange rate volatility can affect the cost structure of exports. A depreciating local currency makes Nigerian exports more cost-competitive in international markets, potentially leading to increased demand for manufactured goods. Based on the findings of this study, it was concluded that exchange rate volatility had significant impact on manufacturing sector export in Nigeria.

Recommendations

Based on the findings, the study made the following recommendations:

1. The study recommended that the government and policy makers should evolve policies that stabilize the naira. For instance, a situation where there exit multiple windows of exchange rate is not helpful.
2. The arbitrage between the parallel markets and the official markets should be reduced if not totally removed.
3. More so, manufacturers that rely heavily on imported raw materials that cannot be easily sourced locally should be made to access the exchange rate at the official rate with ease. This will go a long way in increasing manufacturing sector output for export.
4. Also, there should be increase in strategic marketing and branding of manufacturing sector products to enhance the visibility and reputation of Nigerian exports. This is because a strong brand can make products more resilient to market fluctuations and support consistent demand.

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