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EXCHANGE RATE VARIABILITY AND MANUFACTURING SECTOR PERFORMANCE IN NIGERIA

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ABSTRACT

This study empirically examines the effect of exchange rate variability on the performance of the manufacturing sector in Nigeria from 1987 to 2021, using annual data. The low level of development in the sector has often been attributed to an increasing dependence on the external sector for importing essential manufacturing inputs in Nigeria. The study employs the Vector Error Correction Model (VECM) technique and other econometric procedures, including a unit root test that utilizes the Augmented Dickey Fuller (ADF) test, followed by the Johansen and Juselius (1990) trace and maximum Eigen statistics, to ascertain the presence of co-integrating correlation between the variables. The study variables include manufacturing capacity utilization (MCU) as a proxy for measuring manufacturing sector performance, exchange rate fluctuations (EXFL), broad money supply (MS2), nominal interest rate (INTR), and inflation rate (INFL) as measures of exchange rate fluctuation, alongside the degree of trade openness (TOP) as a control variable. The findings of the study indicate that the joint effect of exchange rate fluctuation measures reveals a non-significant negative effect on manufacturing sector performance in Nigeria. In contrast, the long-run joint effect was positive and significant. Conversely, the individual exchange rate fluctuation variables (INFL, INTR, MS2) exerted positive effects in both the long and short run, but significance was only observed in the long run. However, money supply, inflation rate, and interest rate, as controlled by the degree of trade openness, exerted significant negative effects. At the same time, in the short run, they all had a non-significant positive effect on manufacturing sector performance in Nigeria. As recommendations, the study suggests, among other things, that the government should implement policies on export strategies to encourage exports and discourage unnecessary imports to achieve a favorable balance of payments, as this will result in currency appreciation rather than depreciation, thus enhancing manufacturing output.

Keywords: exchange rate, exchange rate variability, manufacturing sector, money supply, inflation rate, interest rate, trade openness

JEL: E31, F13, H50, O14

INTRODUCTION

In modern economies, the manufacturing sector can generally accelerate growth and development. One primary reason for this is the nature of activities in the sector, which is believed to involve significant linkages across other sectors regarding contribution to and from these sectors. However, the manufacturing sector in Nigeria is still underdeveloped, with a very low capacity

utilisation and contribution to aggregate output, although it is considered the fastest-growing sector in Nigeria since 1973. Low level of development in the sector has often been attributed to increasing dependence on the external sector to import essential manufacturing inputs. Inability to source foreign exchange at affordable rates can impair import capacity, negatively impacting manufacturing performance (Alagidede & Ibrahim, 2017).

However, maintaining exchange rate stability over time has been a challenge for most developed and developing countries. The exchange rate is a significant macroeconomic variable because its depreciation or appreciation impacts all sectors of the economy, particularly the manufacturing sector. Through international trade, economies have faced periods of exchange rate fluctuations and slower growth, which have exposed many developing countries to imbalances. Moreover, exchange variability affects not only economic growth but also firm performance. For instance, exchange rate depreciation raises the cost of imported capital goods for manufacturing firms, leading to a decline in domestic investment, among other effects. Therefore, the manufacturing sector plays a vital role in the modern economy worldwide, with potential benefits crucial for economic transformation (Ayobami, 2019).

Nonetheless, the contribution of the manufacturing sector(firm) to the growth of the country and the improvement in the socio-economic welfare of the populace, one key problem faced by the manufacturing sector in Nigeria is exchange rate variability. This is so because the manufacturing sector depends highly on imported capital goods or raw materials to undertake its production activities; hence, any variability in the exchange rate has significant repercussions on the growth (performance) of the sector, among others. In an economy that is driven by the importation of capital goods and raw materials to feed its manufacturing sectors, the sector has been plagued by numerous setbacks as a result of exchange rate variability, making it less competitive locally and globally (Ofori *et al.*, 2018; Alagidede & Ibrahim, 2017).

The erratic variability in exchange rate, also referred to as exchange rate volatility, could be described as periods of domestic currency appreciation or depreciation. Sequel to 1986 when the Federal Government adopted the structural adjustment policy (SAP), the country moved from a rigid regime to a flexible exchange rate regime where exchange rate is left completely to be determined by market forces but rather the prevailing system is the managed float whereby monetary authorities intervene periodically in the foreign exchange objectives. This inconsistency in policies and lack of continuity in exchange rate policies aggravated the unstable nature of the naira rate. It should be noted that the goal of every economy is to have a stable exchange rate with its trading partners. This goal has not been reached in Nigeria, irrespective of the fact that the country embarked on devaluation to promote exportation and stabilize the exchange rate (Okigbo, 2008).

Nigeria has relied heavily on the oil sector as the main source of income and foreign exchange earnings. For example, the oil sector has been contributing between 76 per cent and 95 per cent to export earnings and 72 per cent and 85 per cent to government revenue between 2011 and 2020 (Agu & Nyatanga, 2020; Omolade *et al.*, 2019). Since 1980, the oil sector's contribution to the Nigerian economy has increased while the manufacturing sector's contribution has decreased. Though oil prices have been unprecedentedly fluctuating, COVID-19 has spirally affected the economies that depend mainly on oil revenue to finance their budgets.

The continual decline in oil prices forced OPEC to reduce its members' oil quota from 1.7 million barrels daily in 2019 to 0.6 million in 2020. The decline in oil price and subsequent reduction in oil production volume tend to adversely affect the manufacturing sector output and Nigeria's economy in general. This volatility of oil prices may impact the inflow of revenue into the economy, thus affecting the exchange rate and the interest rate. This is expected to negatively affect the manufacturing sector's capacity, as it may limit their capacity to import raw materials and other inputs for production. So, if the industrial sector's growth is negatively affected, the economic growth would be negatively affected. This would result in a high cost of production due to exchange rate depreciation, causing an increase in the cost of the sector's output and finished goods (Adebayo, 2011).

The variability of exchange rates is linked to uncertainty and unpredictable fluctuations in relative prices within an economy, indicating a deviation from an unobservable equilibrium or benchmark. The adjustment program introduced in Nigeria in mid-1986 aimed to stabilize the economy, stimulate exports and investment, and promote economic growth. Several measures have been implemented, particularly in removing administrative controls and introducing greater autonomy and competition into production and business. This goal was not achieved in Nigeria despite its efforts to devalue its currency to boost exports and stabilize the exchange rate. The failure to achieve this goal left the Nigerian manufacturing sector facing the challenge of a constantly fluctuating exchange rate. This situation was driven by the devaluation of the naira, the sector's weak and narrow productive base, and the rising import bills (Nwokoro, 2017).

A critical component of SAP was the deregulation of exchange rates, which aimed to make foreign exchange more accessible for production, thereby increasing manufacturing output and employment while reducing inflation (Adegbemi, 2018). The program aimed to enhance the manufacturing sector's performance by reducing import dependence and promoting manufacturing for export. One of the major objectives of the reform was exchange rate deregulation, which allowed for market-driven exchange rate determination (Nwokoro, 2017). Statistically, the exchange rate in Nigeria increased from 1.75 per USD in 1986 to 8.04 per USD in 1990. It then rose to 21.9 and 92.34 per USD in 1995 and 1999, respectively, and increased to 120.58 per USD in 2002 and 131.27 per USD in 2005. By 2010 and 2014, it had risen to 150.3 per USD and 158.55, respectively. The trend rose from 305.79 per USD in 2017 to 358.8 per USD in 2020 (WDI, 2020). Additionally, an examination of the manufacturing sector's share of GDP in recent years indicates that it has not been relatively stable. In 1990, it was about 5.5%, while it dropped to 2.22% in 2010. It grew to 7.18% in 2011 and 7.79% in 2013, further rising to 9.53% in 2015 before dropping to 8.860% in 2018 and then rising again to 13.01% in 2020.

The Nigerian manufacturing industry's critical challenge is inadequate raw materials for producing finished products. This condition tends to negatively affect the productivity level of the sector (Okorontah & Odoemena, 2016). The manufacturing industry's ability to import input materials depends on the exchange rate level. Most organizations source their inputs externally. Hence, the devaluation or depreciation of the exchange rate tends to significantly impact the sector's performance (Nsofo *et al.*, 2017). The link between exchange rate movement and the performance of the manufacturing sector has been examined by various studies (Enekwe, Ordu & Nwoha, 2013; Akinlo & Adejumo, 2014; Alabi, 2015; Lawal, 2016; Nwokoro, 2017; Nsofo *et al.*, 2017; Ugwu, 2017; Adegbemi, 2018; Falaye *et al.*, 2018; Hunegnaw, 2018; Oriji *et al.*, 2019) in both developed

and developing countries. For instance, studies such as Falaye *et al.* (2018) and Nwokoro (2017) showed that exchange rate volatility negatively and significantly affects the manufacturing sector. Furthermore, the findings of Akinlo and Adejumo (2014), Lawal (2016), and Oriji *et al* (2019) found a positive and significant impact of exchange rate on the performance of the manufacturing sector. However, King-George (2013) found that exchange rate volatility has no significant effect on the manufacturing sector in Nigeria. The differences in their findings call for further investigation. Hence, it is against this backdrop that this study seeks to examine the impact of exchange rate variability (depreciation or appreciation) on manufacturing sector performance in Nigeria.

Although the manufacturing sector is an energetic sector for economic growth for developing nations worldwide, including Nigeria, a country intending to expand its economy must do well to ensure that it creates a macroeconomic environment that will aid manufacturing firms to thrive. Since introducing the structural adjustment programme (SAP) in 1986, the Nigerian economy has become more open to market forces and their attendant problems. Over the years, the Nigerian economy has had to deal with problems of unstable exchange rate, high interest rate, high inflation rate, unstable manufacturing sector output, high and increasing unemployment rate, trade imbalances, which have adversely affected manufacturing sector output in Nigeria. Economists differ on which policies could enhance long-run manufacturing sector output. However, maintaining a realistic exchange rate for the naira in Nigeria is crucial, given the peculiar structure of the Nigerian economy.

LITERATURE REVIEW

Theoretical framework

The optimal currency area (OCA) theory, developed by Mundell (1961) and McKinnon (1963) is what this study relies on. This model focuses on trade and stabilization of the business cycle. It is based on concepts of the symmetry of shocks, degree of openness, and labour market mobility. According to the theory, a fixed exchange rate regime can increase trade and output growth by reducing uncertainty. Thus, the cost of hedging also encourages investment by lowering the currency premium from interest rates. On the other hand, it can also reduce trade and output growth by stopping, delaying, or slowing the necessary relative price adjustment process. Also, in the standard Dornbush (1976) model, unanticipated monetary policy shocks generate large variations in the exchange rate. Here, nominal shocks only affect the real exchange rate in the short run. Since the real exchange rate deviates from its long-run equilibrium path, extant studies on the cause of the deviations and results are largely torn between two schools.

Early studies documented the significant relationship between real exchange rate fundamentals, including supply and demand factors, where the former largely relate to the level of output capacity and are expected to follow the Balassa–Samuelson hypothesis. This hypothesis assumed that productivity increases in tradable sectors, pushing up wages. This, in effect, puts an upward pressure on wages in the non–tradable sector and the economy as a whole. Since productivity does not increase in response to a wage rise, prices of non-tradable goods are expected to rise, leading to an increase in the relative price of non-tradable to tradable goods, hence, an appreciation of the domestic real exchange rate (Ajakaiye, 2001; Adeoye & Atanda, 2012). The demand factors relate to the role of government expenditure, while the external shocks reflect changes in terms of trade, trade openness and capital flows. Later theories focused on financial market stabilization of

speculative financial behaviour, particularly in emerging economies.

The optimum currency areas (OCAs) theory suggests that several variables can help to explain patterns of exchange rate variability and intervention across countries because the same factors that inform the decision of whether to form a currency union also influence exchange rate volatility across countries (Antwi *et al.*, 2013). According to the OCA proposition, the higher the intensity of trade links among countries and the more similar the shocks to their output, the more stable (or less volatile) the exchange rate of the national currencies will be (Horvath, 2005). The volume of trade among countries, asymmetric shocks (which occur when unexpected disturbances affect one country's output differently from another's), and differences in countries' (economic) size, are germane to explaining volatility in exchange rates. It has been argued that bringing these variables under control through forming a currency union can potentially reduce exchange rate volatility (Aroriode & Ogunbadejo, 2014).

Furthermore, the occurrence of a supply disturbance negatively affects the exchange rate variance. Driskill & McCafferty (1987) extended their previous work (Driskill & McCafferty, 1980) by: (i) including the assumption of risk-aversion and the analysis of the goods market, and (ii) adding to the model the asset demand equation derived from optimizing behaviour rather than ad-hoc theory. They concluded that exchange rate volatility is affected positively by the variance of money supply shocks and that multiple equilibria are possible if changes in preferences and technology occur. The study's relevance is that fluctuations in exchange rates will cause instability in purchasing power, negatively impacting investment. On the other hand, the effect on manufacturing profitability and overall income level will also affect investment in the import of inputs, and invariably, the exchange rate. Similarly, the exchange rate is crucial in import and export demands, and it plays a key role in international economic transactions (Ajakaiye, 2001; Adeoye & Atanda, 2012).

It is often said that no nation can remain an autarky due to varying factor endowments, which necessitates nations' interdependence. Nigeria, for instance, is an import-dependent country with a high propensity to import finished goods compared to intermediate inputs. Governments often attempt to ration foreign exchange distribution among competing sectors to create balanced sectoral growth. Manufacturing sometimes receives a concessionary exchange rate to boost employment and production while reducing the cost per unit. The multiplier effects that occur thereafter increase output and employment in the following period. Although critics claim this may reduce the competitiveness of the priority sector and that resources have alternative uses, such an attempt may lead to inefficient allocation of resources and hinder research, innovation, and sustainable development (Dooley et al., 2003; Adeniyi, 2012). Moreover, the importance of the exchange rate derives from the fact that it connects the price systems of two different countries, making it possible for international trade to compare traded goods directly. In other words, the exchange rate links domestic prices to international prices.

Conceptual framework

Exchange rates change whenever the value of one of the two currencies changes. A currency at any point in time appreciates whenever demand for it is greater than the supply. It also becomes less valuable when demand is less than the available supply. Variability in exchange rates is caused by monetary flows regarding changes in interest rate, inflation, budget, and trade deficit or

surpluses. Debit entries in both capital and current accounts of the balance of payments possibly raise the demand for foreign exchange. Similarly, credit entries in the capital and current accounts of the balance of payments increase the supply of foreign exchange. Thus, the domestic currency appreciates whenever credit transactions exceed debit transactions. Also, the domestic currency depreciates whenever the debit balance exceeds the credit balance. Increases in interest rates provide higher rates to lenders, which attract more foreign exchange, thereby causing a rise in exchange rates and appreciation of the domestic currency. Appreciation of a domestic currency stresses export of goods and services and makes imports cheaper. Whereas a fall in interest rates reduces the supply of foreign currencies and the domestic currency depreciates in value, the exchange rate falls. Additionally, domestic goods and services become more expensive than imported goods and services during inflation, causing the country's imports to rise and deplete its external reserve, and also causing the domestic currency to depreciate.

The Nigerian industries are concentrated in light consumer goods; there is hardly any capital and intermediate goods production. Another feature of the manufacturing sector is its over-dependence on imports to supply raw materials and spare parts. There is no single industrial product in which the country is entirely self-sufficient, with its import bill dominated by the cost of raw materials and spare parts for industries. As a result, many factories reduced their scale of operations completely, and even some had to close down completely, with an increase in our unemployment rates, which hovered between 2.8 and 3.5 per cent between 1996 and 1998. From 1999 to date, the unemployment rate has not gone below 11.0 per cent, achieving its highest peak in 2011 with a percentage of 23.9. (CBN, 2016). So much literature confirms the insignificant nature of the Nigerian manufacturing industries in terms of their contribution to economic development. Akinlo (2004) also confirmed this by stressing that the industrial sector of the Nigerian economy was relatively insignificant even starting from independence in terms of its contribution to the gross domestic product (GDP) which ranges from 4.8% in 1960 to 8.3% in 1980 and decline to 8.2% in 1990 and 6.88% in 1995, 6.2 % in 1998 respectively (CBN, 2016).

Most of the earliest manufacturing industries, established by colonial trading companies and a few other international firms, focused on producing light industrial commodities such as detergents, soft drinks, leather goods, textiles, and confectionery. He further pointed out that the post-colonial production policy caused distortions in the sector due to a lack of research and excessive reliance on foreign input. The manufacturing subsector still displays distortions despite the adjustment programmes. According to him, this issue needs to be addressed if the sector is to achieve substantial growth. Uruakpa et al. (2021) observed that a country cannot be considered developed if its industrial sector, particularly the manufacturing industries, is not performing at the required capacity within the economy. The capacity for effective manufacturing indicates a country's development and reduces its dependence on other nations. Loto (2012) noted that it serves to increase productivity in terms of import substitution and export expansion, creating foreign exchange earning capacity, raising employment, and per capita income. It promotes investment growth faster than any other sector of the economy, as well as broader and more efficient linkages among different sectors. Owolabi (2019) pointed out that a country's manufacturing sector's growth rate reflects its economic potential. According to Stephen (2017), the sector is growing at a good pace in Nigeria. However, it has not significantly impacted its percentage share in Nigeria's total GDP, owing to the challenges it faces. These include funding, high cost of production inputs, availability of ready markets, deficiency in infrastructural facilities, multiple tax regimes, trade

policies, corruption, poor accounting and record keeping, non-continuity, and weak corporate governance systems.

Empirical review

Empirically, several studies have examined the effect of the exchange rate on the performance of manufacturing firms in both developed and developing countries. Ayobami (2019) investigated the effect of exchange rate fluctuations on the performance of manufacturing firms in Nigeria from 1981 to 2016. The study uses data from the World Development Indicators of the World Bank and the Statistical Bulletin of the Central Bank of Nigeria. It applies the autoregressive distributed lag model as the estimation strategy. The findings indicate that the growth of manufacturing firms in Nigeria is positively related to exchange rate fluctuations; however, this relationship is insignificant. Williams (2018) studied the impact of exchange rate fluctuations on the performance of selected listed firms in Nigeria from 2012 to 2016. The study employs ordinary least squares regression as the estimation technique. The results reveal that the exchange rate positively and significantly affects firms' performance. Additionally, the study's findings show a positive and significant association between inflation and firms' performance.

Using the vector error correction model (VECM) as the estimation strategy, Akinlo and Lawal (2015) examined the impact of exchange rate instabilities on industrial production in Nigeria. The period of the study was 1986 to 2010. Their study demonstrates a long-run relationship among the industrial production index, the exchange rate, inflation, and money supply. Specifically, the study reveals that currency depreciation had no significant short-run effects on industrial production but had positive long-run effects on industrial production. Furthermore, the study finds that the money supply largely explains variations in industrial production in Nigeria. In a related study, Lotfalipour et al. (2013) investigated the effect of exchange rate on manufacturing sectors' investment in Iran, spanning the period 1995 to 2009. The study utilises annual industry-level data and employs the Generalized Method of Moments (GMM) as the estimation strategy. The study reveals a negative and significant relationship between the exchange rate and manufacturing sector investment.

Abdul-Mumuni (2019) examined the impact of exchange rates on the performance of the manufacturing sector in Ghana for the period from 1986 to 2013. The study uses annual time series data on manufacturing output as a percentage of domestic product, exchange rates, imports, interest rates, and foreign direct investment, applying the autoregressive distributed lag (ARDL) estimation technique. The data is sourced from the World Bank's World Development Indicators. The study reveals that the performance of manufacturing firms is significantly positively related to exchange rates. David and Ameh (2010) examine the effect of exchange rate fluctuations on the Nigerian manufacturing sector over a twenty-year period (1986–2005). The study concluded that fluctuations in exchange rates adversely affected the output of the manufacturing sector. Nigerian manufacturing firms heavily depend on imports of inputs and capital goods, which are paid for in foreign exchange, and for which the rate of exchange is unstable.

Boateng (2019) investigated the effect of the exchange rate on the financial performance of manufacturing firms in Ghana using return on assets and equity as the dependent variables for the period 2009 to 2017. The study uses imports, foreign direct investment, and nominal interest rate as control variables and applies the panel regression as the estimation. The results from the study

show that manufacturing firms' financial performance growth is negatively associated with the exchange rate. Abdul-Mumuni (2016) examined the relationship between exchange rate volatility and Ghana's manufacturing sector's performance. Adopting the Autoregressive Distributed Lag (ARDL) technique, findings from the study revealed that the growth of the manufacturing sector is positively related to the exchange rate but negatively related to imports.

Adekoya and Fagbohun (2016) studied the impact of currency devaluation on manufacturing output growth in Nigeria between 1980 and 2014, employing the Engel Granger cointegration for the long-run relationship, ordinary least squares for long-run estimates, and the Granger causality test for causal relationships. The findings revealed that the inflation rate, exchange rate, interest rate, and export variables (except imports) exert a positive effect on manufacturing output growth. The study suggested the need for currency appreciation rather than depreciation, as the sector relies heavily on the importation of equipment and machinery, as well as raw materials. The causality test indicated a unidirectional causality running from the exchange rate, imports, and credit to the private sector to manufacturing output.

Nwokoro (2017) investigated the influence of variations in foreign exchange and interest rates on Nigeria's manufacturing output from 1983 to 2014 through the application of Ordinary Least Squares (OLS), co-integration, and associated error correction modelling. The variables employed in the study included manufacturing output, government expenditure on the manufacturing sector, capacity utilisation, foreign exchange rate, investment in industrial production, and interest rate. The results showed that the foreign exchange rate (FREX) and interest rates (INTR) have a negative and significant influence on manufacturing output (MANO). Lawal (2016) studied the impact of exchange rate fluctuations on manufacturing sector output in Nigeria for the period from 1986 to 2014, using multiple regression analysis and applying the autoregressive distributed lag (ARDL) model. The results of the ARDL revealed evidence of both long-run and short-run relationships among the variables under consideration. The findings also indicated that the exchange rate has a positive and significant effect on manufacturing sector output. Moreover, the results demonstrated that the exchange rate positively affects manufacturing sector output. Thus, the study recommended that the government implement policies on export strategies to encourage exports and discourage imports in order to achieve a favourable balance of payments.

Hunegnaw (2018) investigated the effects of real exchange rates on manufacturing exports in 10 East African countries. The study used pooled mean group and mean group estimators with an autoregressive distributed lag procedure to analyse disaggregated manufacturing exports, unlike past studies that often examine aggregate exports by adopting traditional empirical methods, subject to various shortcomings. Findings suggest that exchange rate devaluation matters for export performance in Eastern Africa. Oriji *et al.* (2019) estimated the impact of exchange rate (EXCH) movements on the manufacturing sector in Nigeria over the period 1981–2016. Time series data and the ordinary least squares (OLS) estimation technique were employed in this study to address the specified objective. Specifically, the findings showed that EXCH, government capital expenditure (GCEXP), imports and FDI were positively related to MGDP. Falaye *et al.* (2018) examined the impact of exchange rates on the performance of the Nigerian manufacturing sector using the independent variables of exchange rates, such as inflation rates, capacity utilization rate, the manufacturing sector's foreign direct investments, and imports over a period of 25 years. The study's empirical results showed that devaluation of the Naira had a negative impact

on the performance of the Nigerian manufacturing sector.

From a review of all the scholarly studies, this study observed that the researchers ignored manufacturing sector capacity utilization, which is an important variable in an investigation of this kind. The various reviews pointed out a strong disagreement on the effects of exchange rate movement on manufacturing sector performance in Nigeria. This disagreement comes in the form of the direction of the relationship as well as the level of significance of the relationship. These shortcomings have contributed to the knowledge gap in the literature. Another gap in the literature is the coverage of exchange rate variables employed in investigating exchange rate effects on manufacturing sector output in Nigeria. The present study includes all the core exchange rate variables such as exchange rate variability (appreciation/depreciation), money supply, interest rate and inflation rate, and the degree of trade openness as a control variable to determine the actual effect of exchange rate variability on manufacturing sector performance (manufacturing capacity utilization) in Nigeria (1987-2021). Thus, this study was motivated against these established gaps and the desire to contribute to knowledge in literature.

METHODOLOGY

Data

The variables considered in this study are time series. The study relied on annual time series data on manufacturing capacity utilization (MCU) as proxy for measuring manufacturing sector performance, while exchange rate fluctuations (EXFL), broad money supply (MS2), nominal interest rate (INTR) and inflation rate (INFL) as measures for exchange rate fluctuation; and degree of trade openness (TOP) as control variable between the periods 1987 to 2021. The choice of this study scope is informed by the perceived period gap observed in previous literature, which lacked wider study coverage, and also to cover the years that Nigerians' economic potential became popular to the global community due to the structural adjustment programme (SAP).

Model specification

This study adapted the Ayobami (2019) and Williams (2018) model to suit the objectives. Certain on the co-integrating correlation between variables together with the current literature, the VECM with standard assumptions indicating interrelationship between the exchange rate variability variables and manufacturing sector performance variable, as well as the degree of trade openness, is specified as follows: The functional form of the relationship between the variables is expressed as follows:

$$MCU_t = f(EXFL_t, MS2_t, INTR_t, INFL_t, TOP_t \quad 1$$

Transforming the function into econometric form, we have the following:

$$MCU_t = \beta_0 + \beta_1 EXFL_t + \beta_2 MS2_t + \beta_3 INTR_t + \beta_4 INFL_t + \beta_5 TOP_t + \varepsilon_t \quad 2$$

Transforming the equation into a log form, we have;

$$lnMCU_t = \beta_0 + \beta_1 EXFL_t + \beta_2 lnMS2_t + \beta_3 lnINTR_t + \beta_4 INFL_t + \beta_5 TOP_t + \varepsilon_t \quad 3$$

Where MCU = Manufacturing capacity utilization

EXFL = Exchange rate fluctuation (Risk in exchange rate movement)
MS2 = Broad money supply
INTR = Nominal interest rate (Prime lending rate)
INFL = Inflation rate (Nominal inflation)
TOP = Degree of trade openness is a proxy variable to capture the level of economic development and trade restrictions in Nigeria with other countries.
ε_t = is the random error term, which captures all the other explanatory variables not included in this regression model;

For the two models, apriori expectations in line with extant literature are as specified thus:

$$\beta_0 - \beta_5, > 0$$

Estimation procedure

To conform to econometric theory and practice, the descriptive features of the variables are summarised and presented using descriptive statistics. To avert misleading regression output, a test for the presence or absence of a unit root is initially conducted using the augmented Dickey-Fuller (ADF) technique. The Johansen and Juselius (1990) trace and maximum eigenvalue statistics are subsequently employed to ascertain the existence of co-integrating correlation between the variables. The VECM techniques were considered to capture the study's long and short-run dynamics. VECM is a restricted form of the vector autoregressive (VAR) model with co-integrating restrictions incorporated into the specification. It is utilised only if the variables are co-integrated and integrated of the same order (0 or 1). Likewise, all variables in the VECM model are treated as endogenous variables. This limits the long-run behaviour of the variables to align with their co-integrating relations. It is appropriate for this type of study since it has the capability to identify the short and long-run interconnection dynamics of the co-integrated series. Moreover, the resulting VAR from the VECM yields more efficient coefficient estimations. The Akaike Information Criterion (AIC) is used to determine the optimal lag length.

DATA ANALYSIS, RESULTS AND DISCUSSIONS

This section presents the analysis results, including unit root tests, cointegration analysis, and vector error correction. Impulse response functions (IRF) and variance decomposition (VDC) analysis are also carried out.

Descriptive statistics analysis

The study began this section by comprehensively comparing the descriptive statistics of the dataset employed in this study. Table 2 shows the result of the descriptive or summary statistics for both dependent, independent and control variables.

Table 1: Result of descriptive statistics

	MCU	EXCF	MS2	INFL	INTR	TOP
Mean	4.250857	9.142011	10.15720	19.78143	18.55574	35.75857
Median	3.590000	2.495727	2.130000	12.38000	17.95000	34.94000
Maximum	6.680000	50.06829	41.41000	72.81000	29.80000	53.55000
Minimum	2.900000	0.004313	0.028000	5.380000	11.55000	17.32000
Std. Dev.	1.353000	14.55108	13.00526	17.81476	3.745367	9.519534
Skewness	0.801350	1.666471	1.091219	1.703147	1.009405	-0.059257
Kurtosis	2.001755	4.261186	2.840124	4.528869	4.543406	2.362922
Jarque-Bera	5.199158	17.99037	6.983374	20.32958	9.417480	0.612376
Probability	0.074305	0.000124	0.030449	0.000039	0.009016	0.736248
Sum	148.7800	310.8284	355.5020	692.3500	649.4508	1251.550
Sum Sq. Dev.	62.24067	6987.218	5750.651	10790.44	476.9444	3081.132
Observations	35	34	35	35	35	35

Source: Researcher's presentation from E-views 10.0 statistical software

From the result, it could be observed that the mean values were: N4.25 trillion for manufacturing capacity utilization (MCU); 9.14 percent for exchange rate fluctuation (EXCF); N10.15 trillion for broad money supply (MS2); 19.78 percent for inflation rate (INFL); 18.55 for nominal interest rate (INTR); and 35.75 percent for degree of trade openness (TOP). The median values of the variables were: #3.59 trillion for manufacturing capacity utilization (MCU); 2.49 percent for exchange rate fluctuation (EXCF); #2.13 trillion for broad money supply (MS2); 12.38 percent for inflation rate (INFL); 17.95 for nominal interest rate (INTR); and 34.94 percent for degree of trade openness (TOP).

The maximum values were: #6.68 trillion for manufacturing capacity utilization (MCU); 50.06 percent for exchange rate fluctuation (EXCF); #41.41 trillion for broad money supply (MS2); 72.81 percent for inflation rate (INFL); 29.80 for nominal interest rate (INTR); and 53.55 percent for degree of trade openness (TOP). The minimum values were: #2.90 trillion for manufacturing capacity utilization (MCU); 0.004 per cent for exchange rate fluctuation (EXCF); #0.02 trillion for

broad money supply (MS2); 5.38 per cent for inflation rate (INFL); 11.55 per cent for nominal interest rate (INTR); and 17.32 per cent for degree of trade openness (TOP).

From the summary output, the standard deviation values were: #1.35 trillion for manufacturing capacity utilization (MCU); 14.55 percent for exchange rate fluctuation (EXCF); #13.00 trillion for broad money supply (MS2); 17.81 percent for inflation rate (INFL); 3.74 for nominal interest rate (INTR); and 9.51 percent for the degree of trade openness (TOP). From the E-view result, the skewness values of 0.80 and -0.05 for manufacturing capacity utilization (MCU) and the degree of trade openness (TOP), respectively, mirrored a negatively skewed distribution, implying that the distribution had a long-left tail with lower values than the sampled mean. On the other hand, the skewness values of 1.66, 1.09, 1.70, and 1.00 for exchange rate fluctuation (EXCF), broad money supply (MS2), inflation rate (INFL), and nominal interest rate (INTR) respectively mirrored a positively skewed distribution, indicating that the distribution for these variables has a long right tail with higher values than the sampled mean. The results obtained in table 1 for the dataset show that the kurtosis values of 2.00, 2.84, and 2.36 for manufacturing capacity utilization (MCU), broad money supply (MS2), and the degree of trade openness (TOP) were less than 3.0000 required for a normal distribution. Hence, the data for these variables had a flattened curve and produced lower values than the sample mean.

On the other hand, the coefficients of kurtosis of 4.26, 4.52, and 4.54 for exchange rate fluctuation (EXCF), inflation rate (INFL), nominal interest rate (INTR), and interest payments on debt (INTD) respectively were greater than the 3.0000 required for normality. This indicated that the dataset was leptokurtic, meaning it produced higher values than normal. Given the results above, the JB values of 5.19 and 0.61 for manufacturing capacity utilisation (MCU) and degree of trade openness (TOP), with their respective p-values of 0.18, 0.07, and 0.73, which are all greater than 0.05, suggested that the null hypotheses for all the variables were not rejected. This therefore indicated that the dataset was normally distributed.

Unit Root tests and Order of Integration

Table 2: Group unit root test (levels)

Group unit root test: Summary

Series: MCU, EXCF, MS2, INFL, INTR, TOP

Exogenous variables: Individual effects

Automatic selection of maximum lags

Automatic lag length selection based on SIC: 0 to 2

Newey-West automatic bandwidth selection and Bartlett kernel

Method	Statistic	Prob.**	Cross-sections	Obs
Null: Unit root (assumes common unit root process)				
Levin, Lin & Chu t*	3.55506	0.9998	7	233
Null: Unit root (assumes individual unit root process)				
Im, Pesaran and Shin W-stat	-0.21718	0.4140	7	233
ADF - Fisher Chi-square	34.2851	0.0019	7	233
PP - Fisher Chi-square	31.9210	0.0041	7	237

** Probabilities for Fisher tests are computed using an asymptotic

Chi -square distribution. All other tests assume asymptotic normality

Source: Researcher's presentation from E-views 10.0 statistical software

Table 3: Group unit root test (first difference)

Group unit root test: Summary

Series: MCU, EXCF, MS2, INFL, INTR, TOP

Exogenous variables: Individual effects

Automatic selection of maximum lags

Automatic lag length selection based on SIC: 0 to 7

Newey-West automatic bandwidth selection and Bartlett kernel

Method	Statistic	Prob.**	Cross-sections	Obs
Null: Unit root (assumes common unit root process)				
Levin, Lin & Chu t*	-4.11670	0.0000	7	215
Null: Unit root (assumes individual unit root process)				
Im, Pesaran and Shin W-stat	-7.92404	0.0000	7	215
ADF - Fisher Chi-square	98.1745	0.0000	7	215
PP - Fisher Chi-square	182.600	0.0000	7	230

** Probabilities for Fisher tests are computed using an asymptotic Chi

-square distribution. All other tests assume asymptotic normality.

Source: Researcher's computation from E-views 10.0 statistical software

Group unit root test: Summary

Levin, Lin and Chu (LLC) (2002) develop a common unit root process; however, the Im, Pesaran and Shin W-stat, ADF-Fisher Chi-square, and PP-Fisher Chi-square tests were the selected group unit root tests considered for this study. From Tables 4.2 and 4.3, the measurement of the group unit root in the data revealed that the series were not stationary at levels in the 1%, 5%, and 10% significance levels. However, when the series were subjected to further tests at first difference, the variables (MCU, EXCF, MS2, INFL, INTR and TOP) were found to have no unit root at the 1%, 5%, and 1% levels of significance, as shown in Table 4.3. Hence, the null hypothesis was rejected. Since the study has confirmed the stationarity of the variables, it means that the variables chosen for this study are suitable for further analysis.

Johansen cointegration test

The Johansen-Jesulius multivariate approach, employing the trace statistic and maximum eigenvalue statistic, was considered for the cointegration test and is presented in tables 4.4 and 4.5 below. The results of the multivariate cointegration examination, reported below, established three (3) cointegrating equations, utilising both the trace statistic and the maximum eigenvalue statistic.

This is because the values of the trace test and the maximum eigenvalue test statistics in each of the three cointegrating equations were all greater than the critical values at the five per cent level of significance. Since it is established from the multivariate test for cointegration that at least one cointegration equation has been established, the study therefore rejected the null hypothesis that there is no co-integration and, hence, no long-run association among the variables in the specified equation, accepting instead the alternative hypothesis that a co-integration relationship exists among them, indicating a long-term equilibrium association among the various variables concerned. Based on this result, the study concluded that the variables were co-integrated, suggesting a long-run association among them.

Table 4: Unrestricted cointegration rank test (Trace)

Unrestricted Cointegration Rank Test (Trace)

Hypothesized No. of CE(s)	Eigenvalue	Trace Statistic	0.05 Critical Value	Prob.**
None *	0.853112	167.4136	95.75366	0.0000
At most 1 *	0.752566	106.0349	69.81889	0.0000
At most 2 *	0.684521	61.34333	47.85613	0.0017
At most 3	0.449919	24.42610	29.79707	0.1830
At most 4	0.152130	5.300009	15.49471	0.7762
At most 5	0.000597	0.019123	3.841466	0.8899

Trace test indicates 3 cointegrating eqn(s) at the 0.05 level

* denotes rejection of the hypothesis at the 0.05 level
**MacKinnon-Haug-Michelis (1999) p-values

Table 5 Unrestricted cointegration rank test (Maximum Eigenvalue)

Hypothesized No. of CE(s)	Eigenvalue	Max-Eigen Statistic	0.05 Critical Value	Prob.**
None *	0.853112	61.37864	40.07757	0.0001
At most 1 *	0.752566	44.69159	33.87687	0.0018
At most 2 *	0.684521	36.91723	27.58434	0.0024
At most 3	0.449919	19.12609	21.13162	0.0932
At most 4	0.152130	5.280886	14.26460	0.7060
At most 5	0.000597	0.019123	3.841466	0.8899

Max-eigenvalue test indicates 3 cointegrating eqn(s) at the 0.05 level

* denotes rejection of the hypothesis at the 0.05 level
**MacKinnon-Haug-Michelis (1999) p-values

Source: Researcher's computation from E-views 10.0 statistical software

Vector error correction model (VECM) test: long run estimates

The VECM analysis was estimated using the Akaike selection criteria with significance at lag order two (2), as the optimal lag for this study result is shown in Table 10. The VECM long run

estimates showed that MCU, as a measure of manufacturing sector performance, would possibly increase due to exchange rate fluctuation (EXCF, MS2, INFL, INTR) measures and the degree of trade openness in Nigeria in the long run. The constant coefficient of the VECM showed that the level of manufacturing capacity utilization (MCU) in Nigeria is expected to increase by 79.27 per cent as a result of exchange rate fluctuation (EXCF, MS2, INFL, INTR) measures controlled by the degree of trade openness in the long run—further analysis of the long run estimates in the equation.

MCU = 79.27 + 0.42*EXCF - 1.68*MS2 -2.17*INFL - 19.06*INTR - 4.20*TOP 4

Equation 4 revealed that the total value of exchange rate fluctuation (EXCF) variable, controlled by the degree of trade openness (TOP), will positively influence the level of manufacturing capacity utilisation (MCU) in Nigeria in the long run by 0.05 per cent and was found to be significant, all things being equal. On the other hand, the total value of broad money supply (MS2) variable, also controlled by the degree of trade openness (TOP), will inhibit the level of manufacturing capacity utilisation (MCU) in Nigeria in the long run by 0.06 per cent and was found to be significant, all things being equal. The relationship between inflation rate (INFL), controlled by the degree of trade openness (TOP), and manufacturing capacity utilisation (MCU) in Nigeria in the long run had a significant negative effect of 0.21 per cent, ceteris paribus. Lastly, the long run result further revealed that manufacturing capacity utilisation (MCU) in Nigeria experienced a non-significant increase of 0.11 as a result of the interest rate (INTR) controlled by the degree of trade openness (TOP) in the long run, all things being equal.

Analysis of VECM error correction term (ECT) and short-run estimates

Given that the variables were mutually integrated, that is, the variables were integrated at order I(1) suggests that the estimation of the VAR model in its level form cannot be carried out. The estimation was then done using the different forms of VAR, using the vector error correction model (VECM) variant of the structural VAR specification. Among many equations specified, the result of the vector error correction model (VECM) has an unexpected positive coefficient and was also statistically nonsignificant against

The magnitude of the coefficient of 0.0013 implies that approximately 1.3% of the disequilibrium in the system could not be corrected each year, indicating a shift away from the adjustment of the disequilibrium in the short run to equilibrium in the long run, but this was non-significant against theoretical expectations. The VECM short-run test shown in Table 6 revealed that the value of the intercept, which is -0.02, indicates that MCU in Nigeria will decrease by 0.02% when all other variables (EXCF, MS2, INFL, INTR) controlled by TOP are held constant. The results showed that the estimated output model has a good fit and moderately high explanatory power, given its R-squared value of 0.8358 and adjusted R-squared value of 0.7045. In particular, the R-squared value of 0.8358 indicates that about 83.58% of the total variation in the dependent variable was attributed to variations in the independent and control variables. Similarly, the F-statistic value of 7.01 demonstrated that the overall model was statistically significant at the 5% significance level. This is because the computed F-statistic of 7.01 was greater than the tabulated F-statistic of 2.18 at the 5% significance level. This signifies that the independent variables have a joint impact on the dependent variable.

Analysis of the VECM estimates in equation 4 indicates that the previous one lagged period of exchange rate fluctuation (EXCF) controlled by the degree of trade openness (TOP) negatively impacted the current period of manufacturing capacity utilisation (MCU) in Nigeria and was statistically non-significant at the 5% significance level. Consequently, an increase in the previous lagged period of exchange rate fluctuation (EXCF) controlled by the degree of trade openness (TOP) resulted in a corresponding 0.0001% decrease in the level of current period manufacturing capacity utilization (MCU) in Nigeria in the short run, ceteris paribus. Similarly, the VECM results revealed that the previous two lagged periods of exchange rate fluctuation (EXCF) controlled by the degree of trade openness (TOP) negatively impacted the current period of manufacturing capacity utilization (MCU) in Nigeria and was statistically non-significant at the five per cent significance level. Thus, an increase in the previous two lagged periods of exchange rate fluctuation (EXCF) controlled by the degree of trade openness (TOP) led to a corresponding 0.0003% decrease in the level of current period manufacturing capacity utilization (MCU) in Nigeria in the short run, ceteris paribus.

The analysis of VECM estimates in equation 4 indicates that the preceding lagged period of broad money supply (MS2), influenced by the degree of trade openness (TOP), had a positive impact on the current period of manufacturing capacity utilization (MCU) in Nigeria, although it was statistically non-significant at the five percent significance level. Consequently, an increase in the preceding lagged period of broad money supply (MS2) controlled by the degree of trade openness (TOP) resulted in a corresponding 0.05 percent increase in the level of current period manufacturing capacity utilization (MCU) in Nigeria in the short run, ceteris paribus. Likewise, the VECM results revealed that the previous two lagged periods of broad money supply (MS2), also influenced by the degree of trade openness (TOP), had a positive impact on the current period of manufacturing capacity utilization (MCU) in Nigeria, which was statistically non-significant at the five percent significance level. Thus, an increase in the previous lagged period of broad money supply (MS2) controlled by the degree of trade openness (TOP) led to a corresponding 0.08 per cent increase in the level of current period manufacturing capacity utilization (MCU) in Nigeria in the short run, ceteris paribus.

Furthermore, the analysis of the VECM estimates in the equation indicated that the previous lagged period of the inflation rate (INFL), influenced by the degree of trade openness (TOP), positively impacted the current period of manufacturing capacity utilization (MCU) in Nigeria, although it was statistically non-significant at the five percent significance level. This implies that an increase in the previous lagged inflation rate (infl), controlled by the degree of trade openness (top), resulted in a corresponding 0.03 per cent increase in the current level of manufacturing capacity utilization (mcu) in Nigeria in the short run, ceteris paribus. Conversely, the VECM results revealed that the previous two lagged periods of the inflation rate (infl), also influenced by the degree of trade openness (top), had a negative impact on the current period of manufacturing capacity utilisation (mcu) in Nigeria, which was statistically non-significant at the 5 per cent significance level. Consequently, an increase in the previous lagged inflation rate (INFL), controlled by the degree of trade openness (TOP), led to a corresponding 0.03 per cent decrease in the current level of manufacturing capacity utilisation (MCU) in Nigeria in the short run, ceteris paribus.

Lastly, the analysis of VECM estimates in equation one showed that the previous one lagged period of interest rate (INTR) controlled by the degree of trade openness (TOP) had a negative impact on

the current period of manufacturing capacity utilisation (MCU) in Nigeria was statistically non-significant at the five percent significance level. Consequently, an increase in the previous lagged period of interest rate (INTR), controlled by the degree of trade openness (TOP), resulted in a corresponding 0.03 percent decrease in the level of current period manufacturing capacity utilisation (MCU) in Nigeria in the short run, ceteris paribus. Similarly, the VECM results revealed that the previous two lagged periods of interest rate (INTR), controlled by the degree of trade openness (TOP), had a negative impact on the current period of manufacturing capacity utilisation (MCU) in Nigeria and were statistically non-significant at the five percent significance level. As a result, an increase in the previous lagged period of interest rate (INTR), controlled by the degree of trade openness (TOP), led to a corresponding 0.0009 percent decrease in the level of current period manufacturing capacity utilisation (MCU) in Nigeria in the short run, ceteris paribus.

CONCLUSION AND RECOMMENDATIONS

This study was undertaken to empirically examine the effect of exchange rate variability on manufacturing sector performance in Nigeria. The low level of development in the sector has often been attributed to an increasing dependence on the external sector for the import of essential manufacturing inputs. Inability to source foreign exchange at affordable rates can impair the capacity to import, thus negatively impacting manufacturing performance (Alagidede & Ibrahim, 2017). However, maintaining exchange rate stability over time has been a challenge for both developed and developing countries. The exchange rate is a significant macroeconomic variable because its depreciation or appreciation has adverse repercussions on all sectors of the economy, especially the manufacturing sector. Odusola and Akinlo (2003) posit that exchange rate depreciation, in the medium and long term, exerts an expansionary impact on output, while in the short run, exchange rate depreciation does not expand output. The study concluded that exchange rate depreciation, both anticipated and unanticipated, lowers real output growth and increases price inflation, indicating that exchange rate fluctuation has a negative effect on economic performance.

From the findings of this study, it can be concluded that the joint effect of exchange rate variability measures revealed a non-significant negative impact on the performance of the manufacturing sector in Nigeria, while the long-run joint effect was positive and significant. On an individual proxy basis, exchange rate fluctuations, controlled by the degree of trade openness, exerted positive effects in both the long-run and short-run periods, but were only significant in the long-run period.

Lastly, the study concluded that the money supply, inflation rate, and interest rate, all influenced by the degree of trade openness, will exert significant negative effects. However, in the short run, they all exerted a non-significant positive effect on the performance of the manufacturing sector in Nigeria.

The study recommends that the Government implement export strategies to encourage exports and discourage unnecessary imports to achieve a favourable balance of payments, as this will lead to currency appreciation rather than depreciation, thereby enhancing manufacturing output.

The government should expand its money supply to put more money in the hands of producers and consumers, thereby stimulating increased investment and consumption. Consumers increase purchases and business firms respond to increased sales by ordering more raw materials and

other resources to achieve more production, forcing lenders to reduce interest rates.

The government should strive to reduce inflationary pressures in the system by deliberately increasing real income, which would enhance the acquisition of more assets and stocks. This will result in capital gains for the manufacturing sector, thereby improving its capacity utilization.

Lastly, the CBN should consider a comprehensive upward revision of the liquidity ratio threshold and the liquidity positions of commercial banks to enhance their lending capabilities. This will improve the intermediation functions of banks, leading to increased profitability and ensuring that output growth reaches its full potential.

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