EXCHANGE RATE AND INDUSTRIAL SECTOR PERFORMANCE IN NIGERIA

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ABSTRACT
This study examined the effect of exchange rate on industrial output in Nigeria. It employed the autoregressive distributed lag model (ARDL) test of co-integration as the estimation technique. The study found that exchange rate has a negative and statistically significant impact on industrial output at 5 percent significance level in the long run. However, in the short run, the impact of exchange rate on industrial production in Nigeria was found to be positive but not statistically significant at five percent significance level. Exchange rate was found to have a positive and statistically significant impact on quarry and mining output at 5 percent level of significance in both the long-run and short-run periods. To mitigate the adverse effects of exchange rate fluctuations, policymakers and businesses should consider implementing strategies such as hedging or diversifying their currency exposures. Additionally, fostering solid international trade relationships and promoting domestic industrial competitiveness should sufficiently be leveraged on to mitigate against the negative impact of exchange rate volatility. Most importantly the current exchange rate stabilization initiative of the current administration that has seen margin of gain between black market and official forex window shrink should be doubled so as restore needed investment confidence and boost trade.
Keywords: Industrial sector performance, Exchange rate, Stabilization initiative, Fluctuations, Macroeconomic stability
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1. INTRODUCTION
The crucial role of an economy’s industrial sector cannot be over emphasized. An endearing industrial performance generates income and employment opportunities, contributing to the population's well-being. It also presents several complementary social and environmental benefits and drives economic miracles, such as in the transformative reality of East Asian economies (Enwerem & Gylych, 2017; Ndiaya & Lv, 2018; Opoku & Yan, 2019). Performance in the industrial goods sector is primarily driven by supply and demand in the industrial real estate segments and the demand for manufactured products, which can be constrained by contraction of the economy during recessions, evidenced by sectorial drops as companies postpone expansion and produce fewer goods (del-Rio-Chanona et al., 2020). This is even as there is growing compelling reason to leverage on the revised projections by analysts who declared optimism across key macroeconomic indicators, including a minimum of 3%

GDP growth, moderation in overall price levels and a stable foreign exchange market with rates expected to ping-pong between N1,500/$ and N1,600/$. (Proshare research, 2025)

Many factors affect the performance of the industrial sector and one of them which is very critical is exchange rate. Exchange rate fluctuations seriously affect the country's macroeconomic stability, not just the industrial performance. For instance, a sudden depreciation in the exchange rate could increase the cost of imported goods, leading to higher inflation rates. Additionally, exchange rate fluctuations could also affect foreign investment and trade, as it becomes more uncertain and riskier for investors and businesses to engage in international transactions. An over-valued exchange rate hurts the performance of export industries, thereby reducing foreign exchange inflow and leading to unsustainable balance-of-payments deficits. On the other hand, excessive domestic currency depreciation or exchange rate depreciation increases the cost of imported production inputs, fueling inflationary pressures. The Nigerian manufacturing sector imports most of its inputs, thereby raising the cost of production. This situation can hurt the competitiveness of Nigerian manufacturers in the global market, as they face higher production costs than countries with a more robust domestic currency (Hoffmann et al., 2023; Sun, 2023).

The Nigerian industrial sector's productivity has suffered due to exchange rate swings. Reduced productivity has resulted from the unpredictable exchange rate, making it challenging for businesses to plan and run efficiently. Nigeria's industrial sector is highly susceptible because it relies on imported inputs and has a weak currency rate. It has become more difficult for industry operators to produce goods competitively due to the low and unpredictable exchange rate which increase the cost of imported machinery and raw materials. In recent time, the industrial sector that mainly consist of oil and gas (9%), manufacturing (7%) and construction (5%) contributes a cumulative annual average of 23% of the GDP with significant potential for improvement (Nigeria Investment promotion Commission, 2023). This rebound is not unconnected to the reform in the exchange rate management which has instilled stability and the energy investment which has seen improved government effort at shoring up energy generation to boost industrial performance and also removing all non-fiscal barriers to investment and ensuring a competitive business environment (NIPC, 2023). This is against the backdrop of pessimism and unimpressive performance of the sector mainly due to untamed culture of importation of finished goods with severe implication on exchange rate and inadequate financial support for industrial activities, which ultimately has contributed to the reduction in capacity utilization in the country (Obamuyi, et al., 2013).

Furthermore, empirical studies on the impact of exchange rate on industrial sector in Nigeria and other countries showed mixed results. While some studies such as Simon – Oke and Aribasala (2010), Aidi et al., (2018), among others established that exchange rates had significant impact on industrial sector performance, other studies such as Tam – Alasia et al., (2018), Lawal (2016), Celina et al., (2018) and Balogun (2025) showed that exchange rate had insignificant impact on industrial sector. The mixed results from these studies make it difficult to reach a general conclusion about the impact of exchange rate policies on the performance of industrial sector in Nigeria. Hence necessitating a further empirical investigation on the impact of exchange rate policies on industrial sector performance in Nigeria.

2. LITERATURE REVIEW

2.1 CONCEPTUAL ISSUES

Exchange Rate: It is the rate at which a domestic currency exchanges with a unit of foreign currency. An exchange rate between two currencies is the rate at which one currency will be exchanged for another. Exchange rates are determined in the foreign exchange market, which is open to a wide range of different types of buyers and sellers where currency trading is continuous. Exchange rates are volatile, making it hard to estimate their influence on the industry. Exchange rates can affect companies in internationally competitive industries even if they have no foreign operations or exports but face significant foreign competition in their domestic market. Foreign exchange market intervention by governments and central banks can create uncertainty and make forecasting exchange values difficult. Economic exposure, the risk that unplanned exchange rate swings would disrupt business cash flows, can significantly impact industrial performance. Due to the expense of importing supplies and the global competitiveness of domestic products, exchange rate fluctuations can significantly impact industrial output (Dornbush, 1988; Harberger, 2004; Montiel, 1999).

Industrial Performance

The ability of a country's industries to create goods and services efficiently and effectively, as well as compete in domestic and international markets, is referred to as industrial performance in an economy. Various metrics, such as financial ratios, productivity, and competitiveness, can be used to assess industrial performance. Governments influence industrial performance through industrial policy, which targets specific industries, firms, or economic activities with various tools such as subsidies, tax breaks, infrastructure development, protective regulations, and research and development inteventions. However, executing industrial policy as part of a growth strategy can be difficult since countries are frequently faced with competing objectives such as ensuring long-term economic growth, maintaining financial and budgetary stability, and developing "national champions." Quality, optimization, and automation of industrial processes are all facets of industrial performance (Jetter *et al*., 2018; Lindberg *et al.*, 2015; Meier et al., 2013).

Statistics on industrial growth, firm structure, and overall industrial performance are compiled by the United Nations Industrial Development Organization (UNIDO). The lack of productivity and industrial performance is a primary challenge affecting economic growth. To remain competitive, businesses must guarantee that their industrial processes, products, and services are efficient and effective. This study measured industrial performance by adding up the aggregate industrial output.

2.2 THEORETICAL LITERATURE

The Elasticity Approach to Exchange Rate Determination

The elasticity approach determines exchange rates and their impact on a country's balance of payments. Richard Cooper *et al.* (2000), Robert Mundell (1961), and John Williamson (1982) are credited for making contributions to the analysis of the elasticity approach to exchange rate determination. The theory holds that the value of a country's currency depends on its overall economy, including manufacturing, foreign investments, employment, and trade. The elasticity approach assumes that if the balance of payments is in equilibrium, depreciation can improve the balance of payments. It also assumes that the demand for exports and imports is elastic, meaning that price or income level changes will significantly change the quantity demanded. This theory finds relevance in explaining the fate of an economy in term of industrial output given the exchange rate volatility of elasticity of its net export.

Harrod-Domar Growth Theory

The Harrod-Domar model was developed independently by and the degree Roy F. Harrod in 1939 and Evsey Domar in 1946.The Harrod-Domar Growth Theory is a Keynesian model of economic growth that explains the relationship between economic growth, capital accumulation, and savings. The model suggests that the economy's growth rate depends on the level of national saving and the productivity of investment, which is the capital-output ratio. According to the Harrod-Domar model, there are three kinds of growth: warranted growth, actual growth, and natural growth rate. The natural growth rate is the rate of economic growth required to maintain full employment. The Harrod-Domar model stresses the importance of savings and investment as key determinants of growth. The theory is criticized on the ground that it made several assumptions that are not realistic, such as the assumption of a full-employment level of income already existing, the economy being closed, and no government interference in the functioning of the economy. The theory attempts to solve the problem of economic instability but neglects the problems of development, which is the main concern of underdeveloped countries.

The Harrod-Domar growth theory is relevant to explaining industrial performance because it stresses the importance of savings and investment as key determinants of growth. The model suggests that growth depends on the quantity of labour and capital, and more investment leads to capital accumulation, which generates economic growth. Therefore, while the Harrod-Domar model provides insights into the dynamics of growth and helps determine an equilibrium growth rate for the economy, it is not a comprehensive explanation of industrial performance.

The Neo-Classical Growth Theory

The neoclassical growth theory is an economic model of growth that outlines how a steady economic growth rate results when three economic forces come into play: labour, capital, and technology. The theory was introduced in 1956 by Robert Solow and Trevor Swan. The model first considered exogenous population increases to set the growth rate, but in 1957, Solow incorporated technology change. The theory states that economic growth results from labour, capital, and technology. The theory postulates that short-term economic equilibrium results from varying amounts of labour and capital that play a vital role in production. The theory argues that technological change significantly influences the overall functioning of an economy.

One of the most common criticisms of neoclassical economics is its unrealistic assumptions. The assumption of rational behaviours ignores the vulnerability of human nature to emotional responses. Critics of neoclassical economics argue that it does not consider an individual's interdependence with the system. The neoclassical growth theory is relevant to explaining industrial performance as it outlines the three factors necessary for a growing economy: labour, capital, and technology. The theory postulates that short-term economic equilibrium results from varying amounts of labour and capital that play a vital role in production. The relationship between capital and labour in an economy determines its total output, and technology augments labour productivity, increasing the total output through increased labour efficiency.

2.3 EMPIRICAL LITERATURE

The reviewed empirical studies showed that while numerous foreign studies investigated exchange rate policies and industrial sector performance, domestic studies on exchange rate and industrial sector performance are few and in general, the conclusions were divergent. For instance, Ita *et al*. (2023) revealed that exchange rate had a negative and significant impact on the performance of Nigeria's manufacturing sector using OLS. Habibi (2019) found short-run non-linear effects of exchange rates on the production of non-energy materials, durable manufacturing, consumer goods and business equipment using a Non-linear Autoregressive Distributed Lags (NARDL) method in the USA. Oseni *et al*. (2019) found that real exchange rate volatility determines industrial production and availability of foreign exchange increments arising from the various export drives contributing tremendously to the increase in the industrial output in Nigeria using EGARCH. Segun and Adedayo (2018) found a positive and significant effect of exchange rate on industrial production in Nigeria using OLS.

Akinmulegun and Falana (2018) found that the response of industrial output to the shock from exchange rate was positive and significant, specifically in the initial years. In contrast, the response to shock from other variables was insignificant and less significant than Nigeria's exchange rate using VECM. Aidi *et al*. (2018) found that Nigeria's exchange rate volatility was inversely related to industrial sector performance using GARCH. Nnamocha *et al*. (2017) found exchange rate to have no significant but positive influence on Nigeria's industrial sector growth using OLS. Ilechukwu and Nwokoye (2015) found that real exchange rate was a significant determinant of industrial output in Nigeria using OLS.

Nweze and Ejim (2021) found that using OLS, exchange rate positively and considerably impacted manufacturing firms' market share in Nigeria. Okhankhuele (2021) found a strong and positive correlation between manufacturing companies' output and exchange rate using ANOVA. Using ECM, Olusegun (2021) found a bi-directional causality between the real exchange rate and the manufacturing sector output. Mlambo (2020) found that exchange rate negatively affected manufacturing performance using the panel group FMOLS and PMG. Adebanjo *et al*. (2019) found that a depreciation of the Naira hurt the performance of the Nigerian manufacturing sector and that exchange rates had a negative significant relationship, long-run relationship and causal relationship with the performance of the sector.

Muhammed and Adindu (2023) found that exchange rate volatility negatively impacted each of the selected construction materials with a unidirectional impact, and the same does not happen in reverse. Umoru and Tedunjaiye (2023) found that foreign exchange market variation in Africa hurt the holding of residential buildings in those countries. Using the Pearson Correlation Coefficient and regression analysis, Obaedo and Oseghale (2020) revealed a positive correlation between the naira exchange rate and construction material prices. Njoroge *et al*. (2019) found that exchange rate hurt the performance of residential properties in Kenya in the short run and had a positive effect in the long run. Okungbowa, Osaro, & Eburajolo (2024) study examined the effects of exchange rate and international trade on the economic Misery in Nigeria using the Dynamic Ordinary Least Square (DOLS) technique. The findings revealed significant relationships between all the variables and economic conditions, offering insights crucial for policy formulation and economic management. The study emphasized the need for coordinated policy measures to optimize export competitiveness amidst exchange rate fluctuations. Extrapolating this discovery, one could see that the direction of effect hinges significantly on dynamics associated with exchange rate. The study by Amoke *et.al* (2024) which deployed rather a mathematical optimization tool of goal programming equally warned of dynamics of exchange rate thus advocated exchange rate regime that suite the economic peculiarities of given economy. Kavkav et al (2025) using the Fully Modified Ordinary Least Squares (FMOLS) estimation technique found that exchange rate volatility has a statistically significant negative impact on economic growth which by extension especially when disaggregated affect industrial performance. The study just like Osinusi & Sokunbi (2025) and Amoke *et.al* (2024) urged for increased need to prioritize exchange rate stabilization through sound foreign exchange policies, increased foreign reserves, and export diversification to mitigate the negative effects of currency volatility.

Several studies have apparently been carried out on the impact of exchange rates on industrial subsectors using different methods and in different countries and arriving at divergent findings, but despite the plethora of research on the impact of exchange rates on industrial performance, the studies on the impact of exchange rate on quarry and mining industrial subsector in Nigeria lacking, hence this study is an attempt to fill this gaps.

3. METHODOLOGY

The study employed descriptive and econometric methodologies in analyzing the exchange rate and industrial sector performance in Nigeria. The theoretical foundation of the model is eclectic in nature. To examine the relationship among the variables and also address the raised objective, the study will adopt the ARDL estimation tool. The leeway to this tool is sufficiently informed by the cointegrating behaviour of the variable after a thorough pre-estimation test of unit root. The data for this study was obtained from Statistical Bulletin, Nigeria bureau of statistics, world development indicators (WDI) etc.

Industrial Output Exchange Rate Model

This model is formulated to achieve set objective, and it specifies the relationship between the exchange rate and industrial sector output, holding other things equal. The industrial output exchange rate model is anchored on the Harrod-Domar and Neoclassical Growth Theories. The Harrod-Domar growth theory suggests that growth depends on the quantity of labour and capital, and more investment leads to capital accumulation, which generates economic growth. The neoclassical growth theory's variables, such as technological progress, trade openness, and the level of infrastructure in the economy, can be introduced and augmented by the key independent variable, the exchange rate. Thus, the industrial output exchange rate model can be mathematically specified as follows:

The mathematically specification of equation (2) is given as:

$$INDP = a_0 + a_1\text{PKY} + a_2\text{LAB} + a_3\text{INV} + a_4\text{EXR} + a_5\text{INFRA} + a_6\text{TECH} \quad (3)$$

The econometric specification of equation (3) is given as:

$$INDP = a_0 + a_1\text{PKY} + a_2\text{LAB} + a_3\text{INV} + a_4\text{EXR} + a_5\text{INFRA} + a_6\text{TECH} + e_1 \quad (4)$$

Equation 4 can be written in log linear form, because some of the variables involved are dominated in percentage and some at level, as thus:

$$\text{Log}\,(INDP) = a_0 + a_1\log(\text{PKY}) + a_2\log(\text{LAB}) + a_3\log(\text{INV}) + a_4\text{EXR} + a_5\log(\text{INFRA}) + a_6\text{TECH} + e_1 \quad (5)$$

The ARDL and ECM for industrial output exchange rate model are specified thus below;

$$\begin{aligned}\Delta lnINDP_t = \beta_0 &+ \sum_{k=1}^{n}\beta_1\Delta lnINDP_{t-k} + \sum_{k=1}^{n}\beta_2\Delta lnPKY_{t-k} + \sum_{k=1}^{n}\beta_3\Delta lnLAB_{t-k} \\ &+ \sum_{k=1}^{n}\beta_4\Delta lnINV_{t-k} + \sum_{k=1}^{n}\beta_5\Delta lnEXR_{t-k} + \sum_{k=1}^{n}\beta_6\Delta lnINFRA_{t-k} \\ &+ \sum_{k=1}^{n}\beta_7\Delta lnTECH_{t-k} + \alpha_1 lnINDP_{t-1} + \alpha_2 lnPKY_{t-1} + \alpha_3 lnLAB_{t-1} \\ &+ \alpha_4 lnINV_{t-1} + \alpha_5 lnEXR_{t-1} + \alpha_6 lnINFRA_{t-1} + \alpha_7 lnTECH_{t-1} \\ &+ \varepsilon_1 \ldots\ldots\ldots\ldots\ldots\ldots\end{aligned}$$

$$\Delta lnINDP_t = \alpha_0 + \sum_{k=1}^{n} \alpha_1 \Delta lnINDP_{t-1} + \sum_{k=1}^{n} \alpha_2 \Delta lnPKY_{t-1} + \sum_{k=1}^{n} \alpha_3 \Delta lnLAB_{t-1} + \sum_{k=1}^{n} \alpha_4 \Delta lnINV_{t-1} + \sum_{k=1}^{n} \alpha_5 \Delta lnEXR_{t-1} + \sum_{k=1}^{n} \alpha_5 \Delta lnINFRA_{t-1} + \sum_{k=1}^{n} \alpha_5 \Delta lnTECH_{t-1} + \theta ECM_{t-1} + \varepsilon_1$$

Where;
INDP = Total industrial sector output, measured in naira.
PKY = Physical capital, measured in Nigerian naira and proxy by gross fixed capital formation
LAB = Total labour force measured in number of working age population.
INV = Total investment, is the combination of domestic and foreign investment measured in naira.
EXR = official exchange rate of the Nigerian naira against one US dollar.
INFRA = infrastructure Proxied by electricity consumption per kilowatt
INTR = Interest rate (measured in percentage)
TECH = technological progress proxied by total factor productivity
e_1 is the error term which represents all other variables that affect industrial sector output not captured by the industrial output exchange rate model.
α_0 is the constant term while α_1, α_2, α_3, α_4 , α_5, $\alpha_6$and α_7 are parameters of log(PKY), log (LAB) log(INV), EXR, log(INFRA) , and TECH respectively.
Theoretical expectations of the parameters are:
$\alpha_4 > 0$; $\alpha_1 > 0$; $\alpha_2 > 0$; $\alpha_3 > 0$; $\alpha_5 > 0$ and $\alpha_6 > 0$

4. RESULTS AND DISCUSSSION OF FINDINGS
4.1 Results
Unit Root Test Results

The unit root result is presented in Table 1. The table shows both the ADF and PP unit root test results for all the variables, and it shows that some of the variables were stationary at level while others were stationary after first difference. Specifically, in Table 1, the unit root test result shows that log (INFRA) and POPG variables were stationary at level using both ADF and PP unit root test methods. The unit root test result showed that EXR, INTR, INFRA, log (CIP), log (FDI) log (GOVCE), log (INDP), log (INV), log (LAB), log (MANP), log (PKY), and log (QMP) variables were not stationary at level but became stationary after first difference using both ADF and PP unit root test methods. The order of integration of the variables in Table 1 using ADF and PP unit root test showed a mixed stationarity and this justified the use of the ARDL estimation techniques in this study.

TABLE 1: Unit Root Test Results: ADF and PP**:** summarized result of the unit root test results**;** 1980-2022

Variable	At level		After first difference		Remark
	ADF	PP	ADF	PP	
EXR	-0.5801	-0.5134	-5.7553	-5.3784	I(1)
	(0.9751)	(0.9790)	(0.0001)	(0.0001)	
INTR	-3.4383	-2.9855	-4.0402	-8.3062	I(1)
	(0.0609)	(0.2867)	(0.0155)	(0.0002)	
INFRA	-1.9986	-2.5899	-3.5973	-3.5815	I(1)
	(0.5829)	(0.2867)	(0.0430)	(0.0479)	

Log(CIP)	-1.8469 (0.6638)	-2.0563 (0.5543)	-6.4412 (0.0001)	-6.4500 (0.0001)	I(1)
Log(FDI)	-1.2769 (0.8801)	-0.9439 (0.9409)	-7.8760 (0.0001)	-8.3002 (0.0001)	I(1)
Log(GOVCE)	-1.2156 (0.8942)	-1.2653 (0.8829)	-6.7839 (0.0001)	-6.7832 (0.0001)	I(1)
Log(INDP)	-1.5846 (0.7823)	-2.0761 (0.5437)	-4.3439 (0.0069)	-4.2837 (0.0080)	I(1)
Log(INFRA)	-3.5932 (0.0460)	-3.5650 (0.465)	NE	NE	I(0)
Log(INV)	-1-4081 (0.8411)	-1.9289 (0.6218)	-4.4368 (0.0054)	-4.3763 (0.0063)	I(1)
Log(LAB)	-2.8243 (0.1971)	-2.7175 (0.2352)	-3.5510 (0.0424)	-3.6227 (0.0468)	I(1)
Log(MANP)	-1.3460 (0.8617)	-2.2732 (0.4387)	-9.7154 (0.0001)	-9.5965 (0.0001)	I(1)
Log(PKY)	-1.7255 (0.7221)	-2.1281 (0.5157)	-4.0010 (0.0160)	-4.0234 (0.0155)	I(1)
Log(QMP)	-1.9327 (0.6199)	-2.3932 (0.3776)	-4.2584 (0.0086)	-4.1922 (0.0102)	I(1)
POPG	-3.6621 (0.0403)	-3.8890 (0.0221)	NE	NE	I(0)

Figures in brackets are corresponding probability values of ADF and PP statistics.
NE stands for "not estimated", this is for variables whose series was stationary at level and there was no need to go further.

Source: computation by Author, 2023, with the assistance of E-view 10.

Analysis of the Industrial Output Exchange Rate Model

Optimal Lag Selection for the Industrial Output Exchange Rate Model

This study used VAR lag order selection criteria to determine the lag length. The result is shown in Table 2, and using the Akaike Information Criteria (AIC). The result showed that the optimal lag selection for the industrial output exchange rate model is four (4).

TABLE 2: **Optimal Lag Selection for the Industrial Output Exchange Rate Model**

VAR Lag Order Selection Criteria						
Endogenous variables: LOG(INDP) LOG(PKY) LOG(LAB) INTR EXR LOG(INFRA)TECH						
Lag	LogL	LR	FPE	AIC	SC	HQ
0	-36.231	NA	2.17E-08	2.21698	2.51557	2.32411
1	228.014	420.082	3.63E-13	-8.8212	-6.4325	-7.9642
2	273.595	56.0998	5.55E-13	-8.6459	-4.1671	-7.0389
3	359.036	74.4866	1.82E-13	-10.515	-3.9457	-8.1578
4	520.891	83.00295*	3.97e-15*	-16.30212*	-7.643073*	-13.19533*

* indicates lag order selected by the criterion
LR: sequential modified LR test statistic (each test at 5% level)
FPE: Final prediction error
AIC: Akaike information criterion
SC: Schwarz information criterion
HQ: Hannan-Quinn information criterion

Source: computation by Author, 2023, with the assistance of E-view 10.

The Bounds Test (Co-Integration) Result for the Industrial Output Exchange Rate Model

Table 3 shows the results of the Bounds test result for the industrial output exchange rate model. The F-statistics value of 16.28 is greater than the critical value of 3.61 at the 5 per cent level of the upper bounds. This means that the null hypothesis of no long-run relationship in the industrial output exchange rate model is rejected, and the alternative hypothesis of the existence of a long-run relationship in the variables of the industrial output exchange rate model cannot be rejected. This means that at 5 per cent significance level, there is a co-integration or long-run relationship among the variables in the industrial output exchange rate model.

TABLE 3: **Bounds Test Result for the Industrial Output Exchange Rate Model**

F-Bounds Test		Null Hypothesis: No levels relationship		
Test Statistic	Value	Signif.	I(0)	I(1)
			Asymptotic: n=1000	
F-statistic	16.275	10%	2.12	3.23
K	6	5%	2.45	3.61
		2.50%	2.75	3.99
		1%	3.15	4.43

Source: Computation by Author, 2023, with the assistance of E-view 10.

ARDL Error Correction and Parsimonious Results for the Industrial Output-Exchange Rate Model

Table 4 shows the results of the industrial output exchange rate model. The result of the long-run coefficient of EXR is -0.0008, with a corresponding probability value of 0.0009. This shows exchange rate has a negative effect on industrial output and the result is statistically significant because the corresponding probability value is less than 5 percent level of significance. This means that a one percent increase in exchange rate will lead to about 0.0008 percent decrease in industrial output in Nigeria in the long run, all other things being equal.

The short-run coefficient result of the current period of EXR is 0.0001, with its corresponding probability value of 0.4227. This shows a positive impact of exchange rate on industrial output in the short run and the impact is statistically insignificant given that the corresponding probability value is greater than five percent significance level. This result implies that one percent increase in exchange rate will lead to about 0.001 percent increase in industrial output in the short run, all other things being equal.

The short-run coefficient result of the lag one value (EXR (-1)) is 0.0010 with its corresponding probability value of 0.0014. This shows a positive and statistically significant impact of the lag one-period value of exchange rate on industrial output at 5 per cent level of significance in the short run. This means that one percent increase in lag one period of exchange rate will lead to about 0.0010 percent increase in current industrial output, all other things being equal.

The short-run coefficient result of the lag two value (EXR(-2)) is 0.0010 with its corresponding probability value of 0.0021. This shows a positive and statistically significant impact of the lag two-period value of exchange rate on industrial output at five per cent level of significance in the short run. This means that one percent increase in lag two periods of exchange rate will lead to about 0.0010 percent increase in current industrial output, all other things being equal.

Table 4: ARDL error correction and parsimonious results for the industrial output exchange rate model

Dependent Variable: D(LOG(INDP))				
Variable	Coefficient	Standard error	t-Statistic	Probability
Long run coefficients				
Constant	4.0134	6.2703	0.6401	0.5425
LOG(PKY)(-1)	1.5259	0.1785	8.5485	0.0001
LOG(LAB)(-1)	0.5440	0.9725	0.5594	0.5933
INTR(-1)	-0.0022	0.0039	-0.5608	0.5924
EXR(-1)	-0.0008	0.0002	-5.4597	0.0009
LOG(INFRA)(-1)	0.7129	0.2120	3.3630	0.0120
TECH(-1)	-0.1587	0.0975	-1.6269	0.1478
Short run coefficients and ECT				
D(LOG(INDP)(-1))	-0.0832	0.0723	-1.1510	0.2875
D(LOG(INDP)(-2))	-0.1720	0.0594	-2.8929	0.0232
D(LOG(INDP)(-3))	-0.0925	0.0654	-1.4136	0.2004
D(LOG(PKY))	0.8794	0.0502	17.5290	0.0001
D(LOG(LAB))	2.9759	0.4523	6.5792	0.0003
D(LOG(LAB)(-1))	0.3261	1.0531	0.3096	0.7659
D(LOG((LAB)(-2))	1.1140	0.7050	1.5802	0.1581
D(LOG(LAB)(-3))	-2.2086	0.6651	-3.3209	0.0128
D(INTR)	0.0025	0.0012	2.1609	0.0675
D(INTR(-1))	-0.0004	0.0031	-0.1427	0.8905
D(INTR(-2))	0.0010	0.0021	0.4651	0.6560
D(INTR(-3))	-0.0020	0.0015	-1.3005	0.2346
D(EXR)	0.0001	0.0001	0.8515	0.4227
D(EXR(-1))	0.0010	0.0002	5.1284	0.0014
D(EXR(-2))	0.0010	0.0002	4.7574	0.0021
D(EXR(-3))	0.0011	0.0002	4.7712	0.0020
D(LOG(INFRA)	0.1621	0.0941	1.7233	0.1285
D(LOG(INFRA(-1))	-0.0148	0.0908	-0.1632	0.8749
D(LOG(INFRA(-2))	0.1434	0.0627	2.2858	0.0562
D(LOG(INFRA(-3))	0.2283	0.0547	4.1755	0.0042
D(TECH)	0.3014	0.1659	1.8170	0.1121
D(TECH(-1))	0.0813	0.0938	0.8668	0.4148
D(TECH(-2))	-0.3783	0.1061	-3.5649	0.0092
D(TECH(-3))	0.1491	0.0968	1.5402	0.1674
ECT(-1)	-0.8620	0.0971	-8.8800	0.0001
Diagnostic test results				
Adjusted R-squared	0.89992	Breusch-Godfrey Serial Correlation LM Test:		
F-statistic	182.8	Obs*R-squared		5.56349
Prob(F-statistic)	0.0001	Prob. Chi-Square(2)		0.0619
Durbin-Watson stat	1.91643	Heteroskedasticity Test: Breusch-Pagan-Godfrey		
		Obs*R-squared		22.47283
		Prob. Chi-Square(15)		0.0960

Source: computation by Author, 2023, with the assistance of E-view 10.

The short-run coefficient result of the lag three value (EXR(-3)) is 0.0011 with its corresponding probability value of 0.0020. This shows a positive and statistically significant impact of the lag three-period value of exchange rate on industrial output at five per cent level of significance in the short run. This means that one percent increase in lag three periods of exchange rate will lead to about 0.0011 percent increase in current industrial output, all other things being equal.

The result of the long-run coefficient of log(PKY) is 1.5259, with a corresponding probability value of 0.0001. This shows a positive impact of capital on industrial output and the result is statistically significant because the corresponding probability value is less than 5 percent level of significance. This means that one percent increase in capital stock will lead to about 1.53 percent increase in industrial output in Nigeria in the long run, all other things being equal. The short-run coefficient result of the current period of log (PKY) is 0.8794, with its corresponding probability value of 0.0001. This shows a positive impact of capital stock on industrial output in the short run and the impact is statistically significant given that the corresponding probability value is less than 5 percent significance level. This result implies that a one percent increase in capital stock will lead to about 0.88 percent increase in industrial output in the short run, all other things being equal.

The error correction coefficient, otherwise called the speed of adjustment, is -0.8620 with corresponding probability value of 0.0001. This is a correct sign and statistically significant because the probability value is less than 5% significance level. This means that about 86.20 percent of the disequilibrium in the short run is corrected in the long run. This is a good speed of adjustment from the short-run disequilibrium to the long-run. The correctness of the sign and the statistical significance of the error correction coefficient confirm the existence of a long-run relationship between the dependent and the independent variables.

The industrial output exchange rate model passed the diagnostic tests, as shown in Table 4. The adjusted R-squared of the industrial output exchange rate model is 0.8999. This means that about 89.99 per cent variation in the dependent variable, log(INDP), can be explained by the variations of the independent variables {LOG(PKY), LOG(LAB), INTR, EXR, LOG(INFRA) and TECH}). This shows that the model has a good fit. Also, the F-statistics for the model is 182.8 with its corresponding probability of 0.0001. This shows that all the independent variables have a significant joint impact on log(INDP), and this is equally good. The Durbin-Watson (D-W) statistics for the model is 1.9164, which is approximately two and, by the rule of thumb, shows no presence of autocorrelation in the estimated model.

4.2 Discussion of Findings

The study found that exchange rate has a negative and significant effect on industrial output in the long run period. But, in the short run, exchange rate was found to have a positive but not significant impact on industrial output. An appreciating exchange rate refers to a situation where the value of one currency rises relative to another. This means that buying a unit of the first currency takes more of the second currency. The appreciation of the naira according to this result will lead to a decrease in industrial production in Nigeria in the long run. This is in accordance with relevant economic theories as the appreciation of the naira can lead to "imported" inflation, where the cost of imported raw materials and machinery for industrial production increases which potentially leads to a higher cost of production. A higher cost of production leads to higher prices of goods and services and may lead to low demand of those products by consumers which will likely result in the reduction of production. This long run finding is not in line with the studies of Segun and Adebayo (2018) who found a positive and significant effect of exchange rate on industrial output in Nigeria using OLS. Ogunmuyiwa and Adelowokan (2018) revealed a positive and significant effect of exchange rate on industrial output in Nigeria using OLS. Akinmulegun and Falana (2018) found that the response of industrial output to the shock from the exchange rate was positive and significant, specifically in the initial years. In contrast, the response to shock from other variables was insignificant and not as significant as the exchange rate in Nigeria using VECM and Nnamocha et al. (2017) found exchange rate to have no significant but positive influence on Nigeria's industrial sector growth using OLS.

The study found that interest rate has a negative insignificant effect on industrial output in the long run but in the short run period, the impact was found to be positive but not significant. The implication of the finding is that interest rate hike will have a detrimental effect on industrial output in the long run but increment in interest rate is not the major factor that can be held responsible for a decline in industrial output. In the short run, interest rate and industrial output move in the same direction, signaling that increase in interest rate may be responsible for the increase in industrial output but an increase in interest rate is not a major driver of industrial output in the short run. This is not in line with theoretical expectations but it may be understood from the standpoint of the marginal efficiency of investment (MEI) concept which asserts that borrowers will consider first the expected rates of return when borrowing money for investment. This means that in the short run, it was profitable to borrow for investment in the industrial sector and that is why despite the increment in interest rate, industrial output was increasing against the expectation of classical theory of investment.

This study found a positive and significant impact of infrastructure on industrial output in the long run period. But in the short run period, the impact of infrastructure on industrial performance was positive but insignificant.

5. CONCLUSION AND RECOMMENDATIONS

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

The negative and significant influence of exchange rate on industrial output in the long run calls for urgent measures to stabilize the currency and mitigate its effects on the industrial sector. This can be done by implementing effective monetary policies and fiscal measures that can help control exchange rate fluctuations and provide stability to industrial output. Additionally, fostering a conducive business environment and promoting export-oriented industries can help reduce the vulnerability of industrial sector to exchange rate volatility. Thirdly, in order to mitigate the adverse effects of exchange rate fluctuations, policymakers should consider implementing strategies such as hedging or diversifying their currency exposures so as to mitigate financial risk associated with external exchange rate shocks. Most importantly the current exchange rate stabilization initiative of the current administration that has seen margin of gain between black market and official forex window shrink should be doubled so as restore needed investment confidence and boost trade.

REFERENCES

Aidi, H.O., Saidu, I.A. & Sulieman, H. I. (2018). Exchange rate volatility and the Nigerian Industrial sector performance. *Saudi Journal of Economics and Finance*, 2(5), 208-215.

Akinmulegun, S.O. & Falana, O.E. (2018). Exchange rate fluctuation and industrial output growth in Nigeria. *International Journal of Economics and Financial Research, 4*(5), 145-158.

Balogun, W. O. (2025). Exchange Rate Devaluation, Economic Growth and Price Stability in Nigeria. *Journal of Economics and Allied Research, 10*(2), 309–319.

Del Rio-Chanona, R. M., Mealy, P., Pichler, A., Lafond, F., & Farmer, J. D. (2020). Supply and demand shocks in the COVID-19 pandemic: An industry and occupation perspective. *Oxford Review of Economic Policy*, *36*(1), 94-137.

Dornbusch, R. (1988) 'Purchasing Power Parity', in the 'New Palgrave: A Dictionary of Economics', NY: Stockton Press.

Enwerem, I. H., & Gylych, J. (2017). Is Industrialization Has Impact the on Economic— Growth, ECOWAS Members' States Experience. *The Journal of Middle East and North Africa Sciences*, *3*, 8-19., 2072-2085.

Habibi, A. (2019). Non-linear impact of exchange rate changes on US industrial production. *Journal of Economic Structures*, *8*(1), 1-17.

Harberger, A. C. (2004). The real exchange rate: issues of concept and measurement. *University of California, Los Angeles*.

Hofmann, B., Mehrotra, A., & Sandri, D. (2022). *Global exchange rate adjustments: drivers, impacts and policy implications* (No. 62). Bank for International Settlements.

Ilechukwu, I.N.& Nwokoye, E.S.(2015). Longrun Impact of Exchange Rate on Nigeria's Industrial Output. *Journal of Economics and Finance*, *6*(5), 75-86.

Ita, I. R., Ekpo, N. S., Chike, E. C., Anthony, O. E., & Loveth, O. (2023). The contributions of exchange rate on the growth of manufacturing sector in nigeria: an econometric approach. *Law and Economy*, *2*(3), 22-28.

Jetter, J., Eimecke, J., & Rese, A. (2018). Augmented reality tools for industrial applications: What are potential key performance indicators and who benefits?. *Computers in Human Behavior*, *87*, 18-33.

Kavkav, S. J., Oyefabi, I. S., Adeshina, K. A., & Tinau, R. A. (2025). Analysis of Oil Price, Exchange Rate, And Economic Growth Nexus in Nigeria. *Journal of Economics and Allied Research*, *10*(2), 84–94.

Lawal, A. I., Nwanji, T. I., Asaleye, A., & Ahmed, V. (2016). Economic growth, financial development and trade openness in Nigeria: An application of the ARDL bound testing approach. *Cogent Economics & Finance*, *4*(1), 1258810.

Lindberg, C. F., Tan, S., Yan, J., & Starfelt, F. (2015). Key performance indicators improve industrial performance. *Energy procedia*, *75*, 1785-1790.

Meier, H., Lagemann, H., Morlock, F., & Rathmann, C. (2013). Key performance indicators for assessing the planning and delivery of industrial services. *Procedia Cirp*, *11*, 99-104.

Mlambo, C. (2020). Exchange rate and manufacturing sector performance in SACU states. *Cogent Business & Management*, *7*(1), 1787735.

Montiel, P. J. (1999). Determinants of the long-run equilibrium real exchange rate: an analytical model. *Exchange rate misalignment: concepts and measurement for developing countries*, 264-290.

Muhammed, A., & Adindu, C. C. (2023). A Granger Causality Test (GCT) Approach to Exchange Rate Volatility on Prices of Selected Construction Materials in North-Central Nigeria. *International Journal of Economics Development Research (IJEDR)*, *4*(2), 149-169.

Mundell, R. A. (1961). A theory of optimum currency areas. *The American economic review*, *51*(4), 657-665.

Ndiaya, C., & Lv, K. (2018). Role of Industrialization on Economic Growth: The Experience of Senegal (1960-2017). *American Journal of Industrial and Business Management*, *8(10)*

Nigerian Investment Promotion Commission Review (2023)

Njoroge, C. G., Muturi, W., & Oluoch, O. (2019). Exchange rate and performance of the residential property market in Kenya. *International Journal of Finance & Banking Studies (2147-4486)*, *8*(3), 88-100.

Nnamocha, P.N., Obioma, B.K., Igwemma, A,A. & Nwoko, I.A.(2017). Foreign Excange and Industrial Sector Growth in Nigeria (1981-2015). *Journal of Economics and Sustainable Development*, *8*(24), 71-80.

Nweze, A. U., & Ejim, E. P. (2021). Effect of exchange rate depreciation on the market share of manufacturing sector in Nigeria. *Advance Journal of Management, Accounting and Finance*, *6*(8), 1-15.

Obaedo, B. O., & Oseghale, G. E. (2020). Impact of naira exchange rate on prices of selected construction materials in Ekpoma, Edo State, Nigeria. *American Scientific Research Journal for Engineering, Technology, and Sciences (ASRJETS)*, *74*(2), 114-123.

Obamuyi, T.M., Edun, A.T. & Kayode, O.F. (2013). Bank lending, economic growth and performance of the manufacturing sector in Nigeria. *European Scientific Journal*, 8(3), 19-36.

Okhankhuele, O. T. (2021). Macroeconomic factors and manufacturing sectors'growth in nigeria. Hallmark University *Journal of Management and Social Sciences (HUJMSS*), 3(1), 90-109

Okungbowa, E. F., Osaro, V. E., & Eburajolo, C. O. (2024). Exchange rate devaluation, international trade and economic misery in Nigeria: Is there a moderating effect. *Journal of Economics and Allied Research (JEAR)*, *9*(3), 261-275.

Olusegun, F. A. O. (2021). Determinants and sustainability of manufacturing sector performance in Nigeria: The roles of selected macroeconomic variables. *Applied Finance and Accounting*, *7*(2), 31-40.

Opoku, E. E. O., & Yan, I. K. M. (2019). Industrialization as driver of sustainable economic growth in Africa. *The Journal of International Trade & Economic Development*, *28*(1), 30-56.

Orji, A., Okeke, C., Ogbuabor, J.E. & Anthony-Orji, O.I. (2018). Another side of the coin: Exchange rate movement and the manufacturing sector in *Nigeria. Journal of Infrastructure Development*, *10*(1-2), 63-79.

Orji, M. C., & Ezeanyaeji, C. I. (2022). Exchange Rate and Manufacturing Sector Performance in Nigeria. *Lapai Journal of Economics*, *6*(2), 13-33.

Oseni, I. O., Adekunle, I. A., & Alabi, M. O. (2019). Exchange rate volatility and industrial output growth in Nigeria. *Journal of Economics and Management*, (38), 129-156.

Osinusi , K. B., & Sokunbi, A. R. (2025). Does Net Foreign Assets and Exchange Rate Have Threshold Effect on Balance of Trade in Nigeria? *Journal of Economics and Allied Research*, *9*(3), 152–164.

Proshare (2025) *Nigeria's H1 2025 Economic Review and H2 Outlook: Bridging the Transition Gaps*, Economy | Reviews & Outlooks.

Segun, O. M., & Adedayo, A. O. (2018). Measuring the impact of exchange rate on industrial output in Nigeria. *European Journal of Marketing and Economics*, *1*(2), 111-117.

Simon-Oke, O.O. & Aribasala, S.E. (2010). Exchange rate deregulation and industrial performance: An Assessment (1975- 2006). *African Research Review*, *4*(2), 236-251.

Sun, M. H. (2023). *Navigating Dollar Funding Shortage and Trade Interventions: Implications for Macroeconomic Stability and Exchange Rate Dynamics* (Doctoral dissertation, American University).