Exchange Rate Fluctuations, Inflation and Industrial Output Growth in Nigeria

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***Abstract*— Over the last 50 years, Nigeria's industrial sector has declined considerably in both productivity and contribution to economic growth in the country. Empirical evidence suggests that exchange rate fluctuations and rising inflation have impaired industrial output growth in the country. This study examined the effect of exchange rate fluctuations and inflation on industrial output in Nigeria. The study covered the period between 1981Q1 and 2016Q4. The study adopted the SVAR econometric technique to analyze the impact of a shock to the independent variables on industry output. The study found that a positive shock to exchange rate has a negative impact on output growth and that a positive shock to inflation has a temporal negative effect on output and becomes positive after the fourth quarter. The forecast error variance decomposition technique showed that exchange rate and inflation account for about 2.6 percent and 10 percent of variations in industry output respectively. The study concluded that although in reality, it may seem as though exchange rate has the largest impact on output growth in Nigeria, empirical evidence from the study showed that inflation is actually the more influential determinant of output growth. The study recommended that the Central Bank should take aggressive steps to reduce exchange rate volatility and ensure price stability in the country through effective control of money supply in order to boost industrial sector performance in Nigeria.**

***Keywords*—** *Exchange Rate Fluctuations, Inflation Rate, Interest Rate, Industrial Output and Growth.*

1. Introduction

Governments all around the world, especially in developing nations believe that industrialization is an effective strategy in eradicating poverty, increasing national output, reducing income inequality, minimizing economic dependence on foreign nations as well as preserving the economic value of a country's currency and its foreign earnings. However, since the advent of globalization, many developing countries including Nigeria who opened their economies to participate in foreign trade and leverage on this system to advance their local economies have instead suffered from stagnated growth in industries due to low competitiveness and inefficient comparative advantage in local production compared to their developed counterparts (Ebong, Udoh, & Obafemi, 2014). The negative impact of the globalization on the industrial sector in emerging countries such as Nigeria is caused by their weak and unstable currencies. This has prompted monetary authorities in the developing countries that keep close trade ties with the developed nations to intervene on totally ad-hoc and episodic basis without any clear sense of sustainable equilibrium. Such exchange rate stability intervention mechanism typically comes too late to prevent severe currency misalignment and volatility. Over the last 50 years, Nigeria's industrial sector has declined considerably in both productivity and contribution to economic growth in the country. This is despite strategic government policy efforts aimed at facilitating industrialization in Nigeria, which is one of the main goals of Vision 20: 2020 (Chete, Adeoti, Adeyinka, & Ogundele, 2014).

Thus, in the pursuit of macroeconomic stability and industrial output growth, monetary policy makers have often set targets on intervening variables which include the exchange rate, growth of money supply and interest rate.

According to Central Bank of Nigeria Annual Statistical Bulletin A (2015), the real economy grew at an average of 5.4 percent between 1985 and 2015. One would ordinarily assume that in a country like Nigeria seeking industrialization, the growth in the real economy will be driven by higher contributions of industrial output to growth, but in reality, the evidence state otherwise. According to data culled from the CBN Statistical Bulletin C (2015), the composition of the total gross domestic product in 1981 was made up of Agriculture with 11.77 percent, Industry with 27.62 percent, Construction

contributed 7.62 percent, Trade contributed 8.63 percent and Services had the largest contribution to GDP with 44.36 percent. By 2015, remarkable changes in the composition of the economy had occurred. Agriculture's contribution to GDP increased to 20.86 percent, Industry's contribution to GDP fell drastically to 16.01 percent, Construction fell to 3.69 percent, Trade more than doubled its contribution to 19.15 percent and Services contribution to GDP reduced by almost 4 percentage points to 40.29 percent. As can be readily observed, industry contribution to overall economic growth has been dwindling in the last 34 years in Nigeria.

The Nigerian industrial sector is composed of crude petroleum and natural gas, solid minerals and manufacturing industries (CBN, 2015). These industries are among the most strategic to the financial fortunes of Nigeria, yet data suggest that the industry as a whole has been lagging behind in terms of overall growth when compared to the other sectors of the economy. According to CBN Statistical Bulletin C (2015), the average manufacturing capacity utilization in 1981 was 73.3 percent. By 2015, average manufacturing capacity utilization in Nigeria had dropped to 53.84 percent. According to Agu, Anichebe and Maduagwu (2016), the manufacturing industry in Nigeria has experienced mild stagnation since the 1980s due to the negative effects of globalization and poor infrastructural development in the country. In line with this argument, Ogu, Aniebo and Elekwa (2016) opined that globalization and trade liberalization are responsible for the snail-pace growth in the Nigerian manufacturing industry. According to Chartered Institute of Management Accountants (CIMA) sector report (2010), manufacturing giants in developing economies compete with their counterparts in developed countries on cost while the industries in developed economies compete with their counterparts in the emerging economies on product quality, technology and innovation. Nigeria has been able to compete effectively on neither as the local industry has failed to be either price competitive or quality driven with regards goods when compared with similar imported products leading to poor patronage of locally produced goods (Ekpo & Bassey, 2016). This point is further buttressed by a surge in import spending on finished goods moving from $1.3b in 1997 to $7.7b in 2007 and Trade contributing more to the overall economy in 2015 than the local industry (CBN, 2015).

The Nigerian Customs Service (NSC) posit that in response to the slowing industrial productivity, the Nigerian federal government introduced industrial incentives such as Manufacturers Exports - In - Bond - Scheme (MEIBS), Export Expansion Grant Scheme (EEG), Bonafide Manufacturers /Assemblers (BMA), Free Trade Zones /Export Processing Zones as well as the Oil and Gas free Zones. These schemes were introduced to encourage import substitution and export promotion (NCS, 2017). Since the Federal Government began introducing these industrial incentives to boost domestic production, the industry is still yet to experience a turnaround. In the meantime, as the government plan to achieve import substitution and expand exportation of goods and services, the exchange rate becomes a very influential policy tool to achieve this objective. Currency devaluation occurs when the exchange rate of a nation is weakened in order to gain competitive pricing advantage in the global market.

Traditional economists opine that devaluation increases the price competitiveness of domestic goods, thus allowing the economy to achieve a higher level of economic activity as consumers turn to local produces to satisfy their wants due to the increase in price of the imported goods in local currency. This also leads to higher exports as the goods sold in the country that devalues its currency appears to be cheaper in the global market immediately after sudden currency devaluation. However, these theoretical treatments largely neglect two important effects following devaluation: (i) The inflationary impact on the price of imported intermediate inputs which raises the prime costs of firms and deteriorates partially or totally their price competitiveness; and (ii) the redistribution of income from wages to profits which affects ambiguously the aggregate demand as workers and capitalists have different propensities to save. New structuralist economists have explored these stylized facts neglected by the orthodox literature and, by and large, conclude that devaluation has contractionary effects on growth and positive effects on the external balance (Ribeiro, Mccombie, & Lima, 2016). While very much against conventional economic wisdom, this finding may be empirically valid in some developing nations where trade globalization has reduced the economic competitiveness and industrial growth.

In Nigeria, the steady currency devaluation from 1981 to 1993, 1999 to 2004 and 2009 to 2017 have not led to higher industrial productivity growth rate in the country. This is evident as the industrial sector dwindled fifteen (15) times between 1982 and 2015, a thirty (34) year observational period following series of currency devaluation during this period (CBN, 2015). The highest positive growth in industrial output during this period was in 1985 with a year-on-year growth rate of 13.45 percent between 1984 and 1985 and the highest negative growth occurred in 1983 after year on year industrial output depleted by 16.07 percent between 1982 and 1983. Between 1981 and 2015, the compound annual growth rate in the industrial sector was just 2 percent whereas the broad economy expanded by 4.5 percent during this period. Higher exchange rate in an import dependent nation can lead to imported inflation. Rising cost of inputs

and final goods causes aggregate demand to fall and a sudden contraction in the productive capacity of the economy. According to Central Bank of Nigeria (2015), inflation averaged 10 percent in Nigeria between 2005 and 2015 compared to 1-2 percent inflation experienced in developed economies; this makes local goods more expensive than imported goods over time on a relative basis.

Against this background, this study thus examines the impact of continuous shocks to exchange rate and inflation on industrial output growth in Nigeria.

2. Literature Review

2.1 Theoretical Framework

Industrial growth is driven by numerous factors which cannot all be captured in one theory. As such, if one theory is used to construct an econometric model to explain variations in industrial output, it will omit several important economic variables, thus making the model inadequate. This is because theories are formulated assuming that one variable can influence changes in another variable assuming all other economic variables are held constant but research has confirmed this assumption erroneous. This study will fuse variables identified in three dynamic theories that in their own right intelligently explain variations in industrial output. These theories will capture the internal factors that drive output growth, monetary factors as well as policy environment that may influence industrial output growth.

These theories include:

1. **Cobb-Douglas Theory of production:** The Cobb-Douglas production function states that the level of output produced in any industry is a function of the total labour force and available fixed capital and the varying degrees to which these variables are combined to the process of manufacturing (Cobb & Douglas, 1928). The Cobb-Douglas production function is often used to analyze the supply-side performance and measurement of a country's productivity potential. It explains that internal factors such as combination of labor and capital are major drivers of output growth in an economy.
2. **Quantity Theory of Money:** Monetarism refers to the followers of Milton Friedman (1867 – 1960) who hold that only money matters and as such monetary instruments are more potent instruments of price and economic stabilization than fiscal policy. This school is known as modern quantity theory of money which holds that inflation is always and everywhere a monetary phenomenon which comes from rapid expansion in quantity of money than the expansion in the quantity of output. That is, if money supply rises faster than the rate of growth of national income then there will be inflation. It explains that the quantity of money in an economy can drive prices of broad goods and services higher or lower. Since the theory of demand and supply states that price affects demand and supply, thus by definition, the quantity theory of money explains that inflation or deflation must equally affect output as the cost of producing a single unit of a product may increase or decrease during periods of inflation or deflation making it more difficult or easier to increase output. Thus, the study affirms that a monetary factor such as inflation must have a significant effect on output growth.
3. **Monetary Policy Transmission Mechanism:** It informs us that factors such as interest rate and exchange rate can drive output growth if the policy environment is accommodative for growth to occur. An accommodative period would be a period of low interest rate which allows manufacturers to borrow for purpose of production and consumers for purpose of consumption thus reducing the financial constraint for both economic agents. A weak exchange rate can boost export demand which leads to expansion in industrial output. In the short run, output tends to respond to changes in interest rate and exchange rate.

In conclusion, a model which portrays labor, capital, inflation, interest rate and exchange rate useful in explaining variations in output growth thus, captures the relevant variables necessary in explaining industrial output growth in Nigeria.

2.2 Empirical Review

Various authorities have embarked on in-depth research on exchange rate fluctuations, inflation and industrial output. To this end, various conclusions have been arrived at by various authorities, some of which have been identified.

Otalu and Keji (2015) in their study assessed the determinants of industrial sector growth in Nigeria. The fall in the contributions of the industrial sector to the growth of Nigerians GDP over the years prompted the study. The need to unravel the problem of the Nigerian industrial sector necessitated studying of the determinants of industrial growth. From the literature the following variables were identified as major determinants of industrial growth in Nigeria; capital (proxy by gross capital formation) labour (proxy by total labour force in the industrial sector) exchange rate, education (proxy by

school enrollment, inflation rate, capacity utilization, trade openness and electricity generation. Co-integration and error correction model was adopted and the result shows that all the identified determinants have more of permanent effect on industrial output than transitory effect. Both labour and capital have significant impact, exchange rate shows a positive and significant impact indicating that currency appreciation might be inimical to the growth of the industrial sector.

Owolabi & Adegbite (2012) examined the effects of foreign exchange regimes on industrial growth in Nigeria. Their study employed Correlation and regression analysis of the ordinary least square (OLS) to investigate the effects of foreign exchange regimes on industrial growth in Nigeria for the period 1985 – 2005. The study revealed that exchange rate had significant effects on industrial growth with the adjusted R2 of 69%.

David, Umeh and Ameh (2010) also examined the effect of exchange rate fluctuations on Nigerian manufacturing industry. They employed multiple regression econometric tools which revealed a negative relationship between exchange rate volatility and manufacturing sector performance.

Barkoulas et al (2002) examined the impact of exchange rate fluctuation on the volume and variability of trade flows. They concluded that, exchange rate volatility discourages expansion of the volume of trade thereby reducing its benefits.

Odusola and Akinlo (2001) examined the relationship between exchange rate, inflation and output in Nigeria. A structural VAR model was employed which captured the interactions between exchange rate and output. Evidence from the contemporaneous models showed a contractionary impact of the parallel exchange rate on output only in the short term. Prices, parallel exchange rate and lending rate were found to be important sources of perturbations in the official exchange rate. In addition, output and parallel exchange rate were significant determinants of inflation dynamics in Nigeria. The authors concluded by suggesting more concerted efforts by the Central Bank towards taming the parallel exchange rate behavior and formulating monetary policies that enhance income growth.

Ilechukwu and Nwokoye (2015) examined the long run impact of exchange rate on Nigeria's industrial output. The study employed the use of the ordinary least square technique to examine the impact of exchange rate stability on industry output in Nigeria using annual time series data from 1980 to 2013. The result of the study showed that domestic capital, foreign direct investment, population growth rate, and real exchange rate were significant determinants of industrial output. The changes in external balance and inflation were of little or no consequences to industrial output. Based on the findings, the researcher recommended that conscious efforts should be made by government to fine-tune the various macroeconomic variables in order to provide an enabling environment that stimulates industrial output.

In addition, similar studies from Nigeria (Akpokodje, 2009; Aliyu, 2010; Aliyu, 2009a; Aliyu, 2009b; Ogunleye, 2009; Olowe, 2009; Yinusa and Akinlo, 2008; Yinusa, 2004 and Yinusa, 2004 among others) have all conducted studies to estimate exchange rate fluctuations, inflation and industrial output in Nigeria. However, most of these studies measure the impact of exchange rate fluctuations on trade balance with little attention to other macroeconomic variable shocks.

3 Methodology

This study employed a quarterly series of selected variables from 1981:1 to 2015:4. The choice of this period is to focus on the era of market based monetary regime in Nigeria from 1986 as well as capture some key activities in the industrial sector in the 1980s. To analyze the impact of shocks on industry output, Adofu & Okwanya (2017) used the Vector Auto-regression (VAR) approach which does not take into account the theoretical underpinnings of the relationship between the variables. As an improvement, the econometric approach to be used in this study is the Structural Vector Auto-regression (SVAR) approach as this is best suited in capturing the dynamic response of estimated variables to various shocks that occur within an economy as well as have a proper theoretical base.

3.1 Model Specification

This study is based on the exchange rate channel of the theory of monetary policy transmission mechanism. Therefore, the model for this study can be specified in an implicit or functional form below:

$IND_t = f\ (LAB_t, GFCF_t, EXR_t, EXPO_t, IMP_t, M2_t, INF_t, MPR_t,)$ …..…… (1)

IND_t is the industry gross domestic product (GDP) at time t.

LAB_t is the total labour force at time t.

$GFCF_t$ is the gross fixed capital formation at time t.

EXR_t is the nominal exchange rate at time t.

$EXPO_t$ is the total national export at time t.

IMP_t is the total national import at time t.

$M2_t$ is the money supply at time t.

INF_t is the rate of inflation as measured by the consumer price index at time t.

MPR_t is the monetary policy rate at time t.

The above implicit form can further be expressed in an explicit form in a non-linear model below:

$IND_t = A.\ LAB_t^{\alpha 1}.\ GFCF_t^{\alpha 2}.\ EXR_t^{\alpha 3}.\ EXPO_t^{\alpha 4}.\ IMP_t^{\alpha 5}.\ M2_t^{\alpha 6}\ INF_t^{\alpha 7}\ MPR_t^{\alpha 8}.\ e_t$…….. (2)

Where α1, α2, α3, α4, α5, α6, α7, α8 are the parameters; t is the time period from 1981:Q1 to 2016:Q4 and e_t is the stochastic error term.

The above equation (2) can be linearized by taking the double log of the equation in order to carry out the several estimation tests and this is shown below:

$lind_t = \alpha_0 + \alpha_1 lab_t + \alpha_2 lgfcf_t + \alpha_3 lexr_t + \alpha_4 lexpo_t + \alpha_5 limp_t + \alpha_4 lm2_t + \alpha_4 linf_t + \alpha_4 lmpr_t + e_t$….(2.1)

3.2 Justification of Variables

IND: Industry GDP is used as a proxy to capture the level of economic output in the industrial sector of a nation. It is the monetary measure of the market value of all final goods and services produced in an industry within a specified period.

LAB: Total labour force is included in this study because labour is one of the factor inputs necessary in the production process and given the labour intensive nature of the Nigerian economy, it makes economic sense to include this variable.

GFCF: The gross fixed capital formation is a proxy for the stock of accumulated capital and is used in this study to capture the physical aspect of capital which is also a vital factor input in the production process.

EXR: Exchange rate is used as a proxy for the exchange rate channel of the monetary transmission mechanism. The exchange rate is the price for which the currency of a country can be exchanged for another country's currency.

EXPO: Exports is the total value of locally produced goods and services sold to foreign nations.

IMP: Imports is the total value of goods and services purchased from abroad for local consumption.

M2: Money supply measures the total stock of money in circulation and deposited in banks that are immediately useable for transactions.

INF: Inflation rate is used as a proxy for inflation in the economy. The consumer price index is a measure to measure the rate of inflation in a country.

MPR: Monetary policy rate is the interest rate that the Central Bank charges deposit money banks for lending funds to these institutions. All other interest rates in the country are anchored on the monetary policy rate.

4 Data Analysis and Results

4.1 Table 1 Optimal Lag Length Test

Sample: 1982Q1 – 2016Q4
Number of obs = 140

Lag	LL	LR	Df	P	FPE	AIC	HQIC	SBIC
0	13.0408				7.60E-12	-0.05773	0.019121	0.13138
1	2391.26	4756.4	81	0	4.30E-26	-32.8751	-32.1066	-30.984
2	2687.45	592.38*	81	0	2.0e-27*	-35.9492*	-34.4892*	-32.3562*
3	2735.34	95.784	81	0.125	3.30E-27	-35.4763	-33.3246	-30.1813
4	2761.77	52.867	81	0.993	7.80E-27	-34.6968	-31.8534	-27.6998

Endogenous: llab lgfcf lexr lexpo limp lm2 linf lmpr lind

Exogenous: _cons

Source: Researcher's computation using STATA 13.

The optimal or appropriate lag length was necessary in order to check if sufficient lags have been included in the VAR as much lags could lead to a waste of the degrees of freedom while too few lags could result to autocorrelation in the residuals as well as a potential misspecification of the equations. This was indicated in table 1 where all the selection criteria (FPE, AIC, HQIC and SBIC) selected two lags.

4.2 Unit Root Test

Table 2 Unit Root Test Results for Stationarity of Variables

Variables	Levels	Remark	First Difference	Remark
Llab	1.958	Non-Stationary	-3.311	Stationary
Lgfcf	-0.375	Non-Stationary	-5.546	Stationary
Lexr	-2.026	Non-Stationary	-7.608	Stationary

Lexpo	-0.187	Non-Stationary	-7.451	Stationary
Limp	-0.919	Non-Stationary	-6.125	Stationary
lm2	-0.572	Non-Stationary	-3.74	Stationary
Linf	-2.384	Non-Stationary	-7.205	Stationary
Lmpr	-2.794	Non-Stationary	-6.797	Stationary
Lind	0.043	Non-Stationary	-6.141	Stationary
Critical Values				
1%	-3.496			
5%	-2.887			
10%	-2.577			

Source: Researcher's computation using STATA 13

The unit root test was used to determine the stationarity or non-stationarity of a given time series. The Augmented Dickey-Fuller test for unit root was used and all variables were found to be non-stationary at levels but were all stationary after the first difference.

4.3 Stability Test

Table 3

Eigenvalue stability condition	
Eigenvalue	Modulus
0.920004	0.920004
0.8958644	0.895864
0.715393	0.715393
0.6370914 + .184175i	0.663179
0.6370914 - .184175i	0.663179
.5539374 + .03837002i	0.555265
.5539374 - .03837002i	0.555265
.4445195 + .1178406i	0.459874
.4445195 - .1178406i	0.459874
-0.2428178	0.242818
-.2005367 + .1280187i	0.237915
-0.2005367	0.237915
-.07730359 + .1653855i	0.18256
-.07730359 - .1653855i	0.18256
-.1643828 + .01771647i	0.165335
-.1643828 - .01771647i	0.165335
-.1027931 + .01287833i	0.103597
-.1027931 - .01287833i	0.103597

Source: Researcher's computation using STATA 13.

All the eigenvalues lie inside the unit circle. VAR satisfies stability condition.

4.4 Lagrange-Multiplier (LM) Test for Autocorrelation

Table 4: Lagrange-Multiplier (LM) Test for Autocorrelation

Lagrange-multiplier test

Lag	chi2	Df	Prob > chi2
1	24.3372	81	1
2	53.8141	81	0.9914

H0: no autocorrelation at lag order

Source: Researcher's computation using STATA 13

From the table above it is observed that the prob>chi2 was not statistically significant at 5 percent at lag 1 and 2 hence, the study did not reject the null hypothesis of no autocorrelation. Therefore, the study concludes that there is no autocorrelation in the residuals.

4.5 Short run SVAR

Table 5: Estimated Coefficients of the Short-Run Variables

	Llab	Lgfcf	Lexr	Lexpo	Limp	Lm2	Linf	Lmpr	Lind
Llab	1	0	0	0	0	0	0	0	0
Lgfcf	-10.03	1	0	0	0	0	0	0	0
Lexr	22.76	0.23	1	0	0	0	0	0	0
Lexpo	-21.80	-0.09	0.06	1	0	0	0	0	0

Limp	-34.36	-0.66	0.07	0.12	1	0	0	0	0
Lm2	-4.61	-0.01	0.00	0.01	0.01	1	0	0	0
Linf	15.82	1.63	0.70	-0.08	-0.51	1.39	1	0	0
Lmpr	55.31	0.88	-0.17	-0.25	-0.50	-0.06	0.04	1	0
Lind	-3.80	-0.13	0.45	-0.00	-0.04	-0.09	0.02	-0.07	1

Source: Researcher's computation using STATA 13

The table above indicates the contemporaneous relationships among the endogenous variables. It should be noted that these values were estimated in their natural forms at levels so as to prevent any loss of information that may arise as a result of differencing the variables.

4.6 Table 6: Level of Significance of Estimated Coefficients of the Short-Run Variables

	Llab	Lgfcf	Lexr	Lexpo	Limp	Lm2	Linf	Lmpr	Lind
Llab	1	0	0	0	0	0	0	0	0
Lgfcf	-0.89	1	0	0	0	0	0	0	0
Lexr	0.99	1.33	1	0	0	0	0	0	0
Lexpo	-1.60	-0.85	1.20	1	0	0	0	0	0
Limp	-2.44	-6.36	1.29	1.36	1	0	0	0	0
Lm2	-1.09	-0.28	0.32	0.51	0.49	1	0	0	0
Linf	0.32	3.99	3.95	-0.27	-1.75	1.41	1	0	0
Lmpr	4.48	8.25	-3.61	-3.41	-6.89	-0.23	2.09	1	0
Lind	-1.19	-4.07	3.82	-0.11	-2.08	-1.52	3.10	3.56	1

Source: Researcher's computation using STATA 13

*The above values are the z-values and it must be > 1.98 to be statistically significant.

4.7 Impulse Response Functions (IRFs)

Table 7: Impulse Response of Industry Output (IND) to shocks in LAB, GFCF, EXR, EXPO, IMP, M2, INF, MPR and IND in Nigeria.

Period	Llab	Lgfcf	Lexr	Lexpo	Limp	Lm2	Linf	lmpr	Lind
0	0.001862	0.000705	-0.002433	0.000543	0.003986	0.000210	-0.000387	0.000356	0.001224
1	0.00244	0.000997	-0.004166	0.000170	0.000620	0.000120	-0.000474	0.000395	0.001696
2	0.002708	0.001029	-0.004328	0.000404	0.000749	-0.000104	-0.000349	0.000253	0.001747
3	0.003011	0.000927	-0.002049	0.000654	0.000791	-0.000346	-0.000116	0.000059	0.001586
4	0.003386	0.000772	-0.002049	0.000815	0.000752	0.000546	0.000141	-0.000129	0.001343
5	0.003719	0.000604	-0.000469	0.000841	0.000650	-0.000680	0.000374	-0.000286	0.001096
6	0.003871	0.000450	-0.001059	0.000741	0.000508	-0.000749	0.000557	-0.000404	0.000871
7	0.003754	0.000312	-0.002373	0.000559	0.000347	-0.000076	0.000678	-0.000047	0.000684

						11		72	
8	0.003361	0.000199	-0.003377	0.003473	0.001855	-0.000725	0.000738	-0.000049	0.000557
9	0.002749	0.000928	-0.004039	0.001493	0.000375	-0.000665	0.000735	-0.000491	0.000446

Source: Researcher's computation using STATA 13.

4.8 Table 8: Impulse Response of Industry Output (IND) to shocks in LAB, GFCF, EXR, EXPO, IMP, M2, INF, MPR and IND in Nigeria in Percentage Values

Period	Llab	Lgfcf	Lexr	Lexpo	Limp	Lm2	Linf	Lmpr	Lind
0	0.19%	0.71%	-0.24%	0.05%	0.40%	0.21%	-0.39%	0.37%	1.22%
1	0.24%	1.00%	-0.42%	0.17%	0.62%	0.12%	-0.47%	0.40%	1.70%
2	0.27%	10.29%	-0.43%	0.40%	0.75%	-0.10%	-0.35%	0.25%	1.75%
3	0.30%	0.93%	-0.20%	0.65%	0.79%	-0.35%	-0.12%	0.06%	1.59%
4	0.34%	0.77%	-0.20%	0.82%	0.75%	0.55%	0.14%	-0.13%	1.35%
5	0.37%	0.61%	-0.05%	0.84%	0.65%	-0.68%	0.37%	-0.29%	1.10%
6	0.39%	0.45%	-0.11%	0.74%	0.5%	-0.7%	0.56%	-0.40%	0.8%
7	0.38%	0.31%	-0.24%	0.56%	0.35%	-0.76%	0.68%	-0.48%	0.69%
8	0.34%	0.19%	-0.34%	0.35%	0.19%	-0.73%	0.74%	-0.50%	0.55%
9	0.27%	0.09%	-0.40%	0.15%	0.04%	-0.66%	0.74%	-0.49%	0.44%

Source: Researcher's computation using STATA 13

The tables above shows the values of the impulse response of Industry Output (IND) to shocks in LAB, GFCF, EXR, EXPO, IMP, M2, INF, MPR and IND in Nigeria in both their actual values and in percentage forms respectively.

4.9 Forecast Error Variance Decomposition (FEVD)

Table 9: Forecast Error Variance Decomposition of Industry Output (IND) to shocks in LAB, GFCF, EXR, EXPO, IMP, M2, INF, MPR and IND in Nigeria.

Period	Llab	Lgfcf	Lexr	Lexpo	Limp	Lm2	Linf	lmpr	Lind
1	0.012418	0.193756	0.022907	0.000111 41	0.061499	0.017133	0.058031	0.051731	0.580385
2	0.012544	0.199119	0.030982	0.000424 6	0.072429	0.000782 6	0.049974	0.038621	0.584258
3	0.013075	0.199347	0.032777	0.001523	0.086285	0.000543 7	0.038832	0.027665	0.581371
4	0.014667	0.19402	0.030618	0.003537 9	0.098402	0.001079 2	0.029029	0.020336	0.566756
5	00.017	0.1845	0.0267	0.0592	0.1057	0.0224	0.0244	0.0172	0.5424

	148	4	21	39	42	51	27	35	98
6	0.20227	0.173325	0.023077	0.078973	0.107742	0.037633	0.026658	0.018083	0.514436
7	0.023409	0.162302	0.02105	0.090135	0.105578	0.053562	0.034797	0.021967	0.487201
8	0.026117	0.152443	0.021193	0.093038	0.101022	0.068128	0.046993	0.027622	0.463403
9	0.027937	0.144081	0.023354	0.090957	0.095777	0.080039	0.060595	0.033682	0.443586

Source: Researcher's computation using STATA 13

4.10 Table 10: Forecast Error Variance Decomposition of Industry Output (IND) to shocks in LAB, GFCF, EXR, EXPO, IMP, M2, INF, MPR and IND in Nigeria in Percentage Values.

Period	Llab	Lgfcf	Lexr	Lexpo	Limp	Lm2	Linf	lmpr	Lind
1	1.24%	19.38%	2.29%	0.11%	6.15%	1.71%	5.80%	5.17%	58.04%
2	1.25%	19.91%	3.10%	0.42%	7.24%	0.78%	5.00%	3.86%	58.43%
3	1.31%	19.93%	3.28%	1.52%	8.63%	0.54%	3.88%	2.77%	58.14%
4	1.47%	19.40%	3.06%	3.54%	9.84%	1.08%	2.90%	2.03%	56.68%
5	1.71%	18.45%	2.67%	5.92%	10.57%	2.25%	2.44%	1.72%	54.25%
6	20.23%	17.33%	2.31%	7.90%	10.77%	3.76%	2.66%	1.81%	51.44%
7	2.34%	16.23%	2.11%	9.01%	10.56%	5.36%	3.48%	2.20%	48.72%
8	2.61%	15.24%	2.12%	9.31%	10.10%	6.81%	4.70%	2.76%	46.34%
9	2.79%	14.41%	2.34%	9.10%	9.58%	8.00%	60.60%	3.37%	44.36%
TOTAL	34.96%	160.29%	23.27%	46.84%	83.45%	30.30%	91.46%	25.69%	476.38%
AVERAGE	3.88%	17.81%	2.59%	5.20%	9.27%	3.37%	10.16%	2.85%	52.93%

Source: Researcher's computation using STATA 13

Tables 9 and 10 displays the forecast error variance decomposition of Industry Output (IND) to shocks in LAB, GFCF, EXR, EXPO, IMP, M2, INF, MPR and IND in Nigeria in actual values and in percentage values respectively. From the tables below, the study found that 52.93 percent of variations in industry output is explained by innovations to itself. Shocks to Gross fixed capital formation and Inflation contributed 17.81 percent and 10.16 percent to variations in industry output respectively.

Shocks to Import, Export and Labour contributed 9.27 percent, 5.20 percent and 3.88 percent to variations in industry output respectively. Shocks to Monetary Policy Rate and Exchange Rate contributed only 2.85 percent and 2.59 percent to variations in exchange rate.

4.11 Discussion of Findings

The study found that a positive shock to labour and capital has a positive impact on industry output. However the effect of a positive shock to capital on industry output is more immediate and more significant than labour subsides after a short period of time. This finding is in line with the Cobb Douglas theory which shows that increases in labour and capital resources have significant but unequal influence on industry output. This means that when the labour force expands rapidly, it has a positive impact on industry output because there will be more labour employed into the production of industrial goods. Also, the study showed that when gross fixed capital formation increases rapidly through an increase in the availability of capital, plants and machineries, industry output increases sharply in response to such positive shock and vice versa. It then becomes important for the government to use policies that increase infrastructure development and increase subsidies for the purchase of plants and machineries in order to boost industrial output.

The study also found that a positive shock exchange rate has an immediate negative impact on industry output but turns positive after the fifth quarter. This is because the industry imports a significant amount of intermediate goods, plants and machineries from foreign nations. A sharp increase in the exchange rate could make the cost of production a lot higher, thus hurting output in the short run. However, the effect of the shock begins to subside as the burden of the cost is then transferred to the consumers. This shows that an exchange rate shock has a negative impact on industry output even though this negative effect is merely temporal. Therefore, the Central Bank must manage monetary policy in a very prudent manner to ensure the stability of exchange rate. If the exchange rate is not managed properly, the country could potentially have negative growth in the industrial sector from time to time. Historically, Nigeria has not been able to manage its exchange rate in a prudent manner, Naira has been depreciated repeatedly over the years and this has led to multiple years of negative growth in the Nigerian industrial sector as was earlier stated in the study.

The also study found that a positive shock to Inflation has an immediate negative impact on industry output but becomes positive after the third quarter. The negative relationship is in line with the theory of demand and supply which states that if price increases, demand falls. Therefore, if there is a price shock in the industry, there will be a fall in output demanded or output produced due to either demand pull inflation or cost inflation respectively. This then makes it imperative that monetary policy is handled in a manner that ensures price stability to ensure steady demand growth and effective industry planning.

5. Conclusion

The rationale that the industrial sector is very vulnerable to changes in exchange rate is more plausible than the data suggests however the argument that exchange rate has more influence on industry output in Nigeria than inflation cannot be empirically justified. The study shows that the higher the rate of inflation in the country, the weaker will be its industry output growth. As firms increase the price of their products and services, citizens begin to substitute these products for their cheaper import substitutes which are typically of higher quality. However, reducing the price of the locally produced goods and services could hurt the profit margins of the companies, thus making them less profitable and unable to grow.

While most firms will cheer lower interest rate to boost the industrial sector, the results in this study suggest that the long run impact of lower interest rate on industry output is actually negative. Therefore, productivity growth in the industry sector is better promoted by improved technology. At this time, the level of local development of technology equipment for industrial production is still poor. Therefore, Nigeria must import her technological equipment until local alternatives are made available. The exchange rate fluctuation limits the access of manufacturers to the much needed foreign exchange currency to purchase these items. Therefore government must step in to ensure that the local industry receive all the technical support to begin to expand at a pace that is in line with the industrialization goals of the country.

In conclusion, the poor growth of the Nigerian industrial sector is traceable to both strong inflationary pressures and exchange rate volatility. However, research has established that the former is a more powerful force than the latter in influencing industry output growth. It then becomes necessary for government policies to be directed at managing inflation and ensuring it stays within the single digit level while simultaneously managing the exchange rate to ensure that exchange rate shocks occur less frequently seeing that these shocks have negative impacts on the industrial sector.

5.1 Recommendations

1. The government should limit the exposure of the industrial sector to exchange rate volatility by investing in local technology alternatives to boost productivity and reduce the country's dependence on technology imports to boost output.

2. To promote growth, government should develop the industrial sectors of the economy through its capital expenditure. With this, capital expenditure on productive activities and social overheads

capital will contribute positively to industrial growth which will invariably enhance economic growth.

3. In order to keep inflation as well as inflation expectations low and stable, government should put more efforts to improve monetary-fiscal coordination through emphasis on fiscal rules.
4. The Central Bank of Nigeria must use smart monetary policy strategies to ensure that inflation does not exceed 12.5 percent.
5. The study recommends that Central Bank put more focus in managing inflation in order to ensure price stability by controlling money supply in the country which the study shows will boost demand growth.

The study also recommends that the Central Bank create a forward contract exchange rate market where the industry players can freely participate in purchasing future contract of their foreign exchange needs early enough to mitigate the risk of a currency devaluation on their business.

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