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Impact of Exchange Rate on Industrial Production in Nigeria 1986-2010

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Abstract

The paper examines the impact of exchange rate on industrial production in Nigeria over the period 1986-2010. The results of the study obtained using the Vector Error Correction Model (VECM), confirm the existence of long run relationship between industrial production index, exchange rate, money supply and inflation rate. Moreover, exchange rate depreciation had no perceptible impact on industrial production in the short run but had positive impact in the long run. Finally, the results show money supply explained a very large proportion of variation in industrial production in Nigeria.

Key words: Exchange rate; Industrial production; VECM; Nigeria

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INTRODUCTION

The adjustment programme introduced in Nigeria in mid 1986 was aimed at stabilizing the economy, stimulate exports and investment, and promote economic growth. Several measures have been taken, especially in removing administrative controls and introducing greater autonomy and competition into production and business. A critical component of the reform is the exchange rate deregulation. This policy entails allowing the forces of demand and supply to determine the ruling exchange rate in the economy. Several measures have been undertaken to make the exchange rate more market based. As an illustration, there was a unification of official and market exchange rates. Also, government evolved a system whereby exchange rate was determined on a daily basis in an interbank system under the supervision of the Central Bank of Nigeria.

This exchange rate policy is assumed would enhance increased access to foreign exchange for production thereby increasing manufacturing output and employment while reducing inflation. Studies have analysed the impact of exchange rate on economic growth and other macroeconomic variables. However, not many studies have analyzed the impact of exchange rate on industrial production. Analyzing the impact of exchange rate on manufacturing output is very crucial because this subsector together with agriculture constitutes the real sector of the economy. Undoubtedly, changes in this subsector will have serious effects on the other sub sectors and economic fundamentals such as employment, inflation and economic growth.

The purpose of this paper is therefore, to examine the impact of changes in real exchange rate on industrial production in Nigeria. The vector autoregressive model is applied to estimate the impulse response functions and variance decompositions for industrial output in order to determine how industrial output responds to a shock to the exchange rate changes, and what proportion of industrial output can be explained by the real exchange rate.

The rest of the paper is structured as follows: section 2 provides a brief overview of the trends of exchange rate and industrial production over the study period. Section 3 provides a brief summary of empirical literature on the effect of exchange rate on output. Section 4 discusses the methodology, section 5 presents the results of the empirical analysis and section 6 contains the conclusion.

1. OVERVIEW OF TRENDS OF EXCHANGE RATE AND INDUSTRIAL PRODUCTION

Figure 1 below shows the movements of the exchange rate and industrial production over the period 1986-2010. The figure shows that industrial production witnessed slight reduction in all the quarters of 1986 but picked up in 1987 only to increase continuously till the fourth quarter of 1990. Industrial production maintained somewhat downward movement over the period 1991 to 1995 with occasional upward movement in some quarters. It assumed upward trend till around year 2000 when there was a slight deceleration. It however, picked up in the third quarter of 2000 only to assume a somewhat upward movement till 2010. However, in between there were quarters in which industrial production marginally dropped.

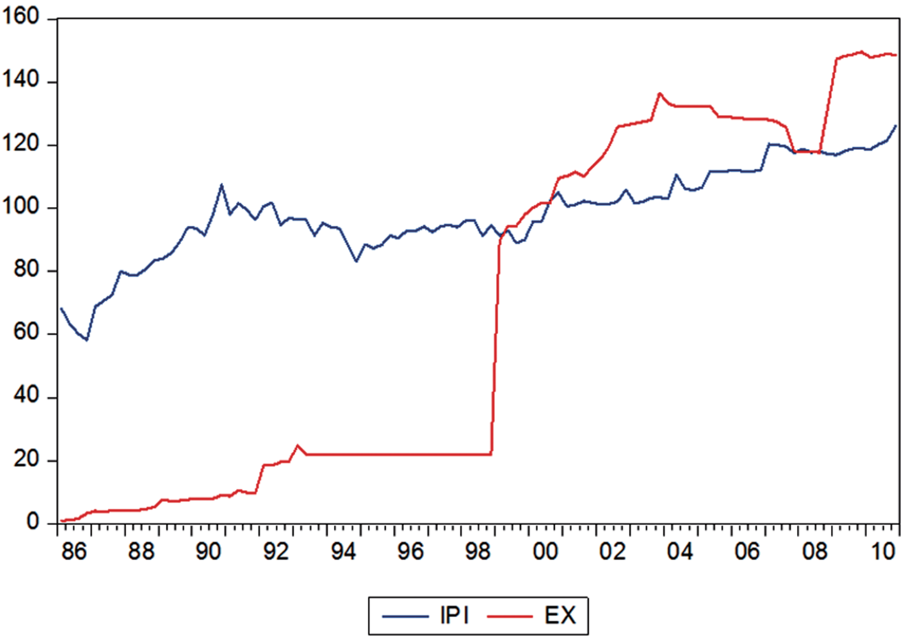

Figure 1
Plot of Exchange Rate and Industrial Production Index

With respect to the exchange rate, it depreciated continuously from the first quarter of 1986 to the last quarter of 1991. The extent of depreciation, however, increased sharply from the first quarter of 1991 up to the first quarter of 1993. The exchange rate assumed constant value from the second quarter of 1993 till fourth quarter of 1998. This could be attributed to policy of managed floating introduced by the government during this period. However, with the change of policy in the first quarter of 1999, the exchange rate depreciated massively. This downward trend continued up till 2003. The exchange rate experienced slight appreciation from 2004 to reach the highest level in 2008. However, exchange rate depreciated sharply from the fourth quarter of year 2008 only to maintain relatively stable value in years 2009 and 2010.

The clear pattern that emerges from figure 1 is that at very low exchange rate, the industrial production is far above the exchange rate. However, with the sharp depreciation of the exchange rate in 1988, industrial production dropped below the exchange rate figure.

2. REVIEW OF EMPIRICAL LITERATURE

Several studies have been conducted on the impact of the real exchange rate on output. Few of the studies have reported positive effect of devaluation (depreciation) on output (Vo, et al. 2000, Terence & Pentecost, 2001). Contrariwise, some studies have reported a negative impact of depreciation (devaluation) on output (Sheeley, 1986; Rogers & Wang, 1995). All the same, few studies have argued that real exchange rate may produce negative or positive impact on output in the short run but neutral in the long run (Edwards 1986; Kamin & Klau, 1998).

With regard to the impact of exchange rate on industrial production, the impact follows the same pattern as aggregate output outlined above. Exchange rate deregulation that increases investors' access to foreign exchange can lead to increased industrial output. Increased access to foreign exchange will enable the investors procure the needed imported raw material and equipment needed for production. In this wise, industrial output can be enhanced. Moreover, increased production can lead to increased employment which may eventually lead to improved wages and increased economic growth. Also, exchange rate depreciation can lead to increased industrial output where domestic firms are exporters. Depreciation of domestic currency makes exports competitive with positive effect on profitability.

In contrast, however, depreciation of domestic currency could have negative impact on industrial output where domestic firms are raw materials import dependent. Depreciation of exchange will lead to increased cost of imported raw materials, which will feed into cost of production and thus higher unit cost. Higher unit cost could make output uncompetitive which may eventually lead to reduction in industrial output.

In short, the nature of the impact of exchange rate on industrial output is yet unresolved. There is therefore the need for more empirical research on the subject matter. This is particularly important in view of the nature of the industrial sector in the developing countries like Nigeria. For one, the sector is relatively small compared with what obtains in developed and other industrialized nations. For another, firms are more raw materials import dependent and produce majorly for domestic consumption.

3. METHODOLOGY

The goal of the paper is to ascertain if exchange rate enhance economic growth. The econometric methodology applied in this work is the Vector Autoregressive (VAR) technique. The basic model employed in this study is expressed as:

$$IPI_t = \alpha_0 + \alpha_1 EX_t + \alpha_2 INF_t + \alpha_3 MS_t + \varepsilon_t \quad (1)$$

The variable IPI in the industrial production index. EX is the real exchange rate, INF is the rate of inflation measured as consumer price index (1980 =100) and MS is the money supply broadly defined. Inflation (INF) and money supply (MS) are critical factors for exchange rate impact on industrial production. Hence, excluding the two variables may cause a problem of omitting relevant variables which may result in imprecise estimation of the model.

As time series are often characterized by high degree of persistence; we first determine the order of integration or the stationarity of each series by applying Augmented Dickey-Fuller (ADF, 1975) and Kwiatkowski-Phillips-Schmidt-Shin (KPSS, 1992) unit root tests. Where the order of integration of the series is the same, it is possible that these series are cointegrated. To test for cointegration, Johansen and Juselius (1990) formulated two likelihood tests data involving two distinct series. The variables are cointegrated if and only if a single cointegrating equation exists. The main reason for the maximum likelihood estimation is to test the independent number of cointegrating vectors in the VAR model.

In the 4-variable model of IPI, EX, INF, MS we consider x_t as a 4 x 1 vector which consists of the 4 variables; a more general specification of multivariate model can be depicted as:

$$x_t = \theta + \sum_{i=1}^{T-1} \Gamma_i x_{t-i} + \Pi x_{t-T} + \varepsilon_t$$

where $\Gamma_t = -1 + A_1 + \ldots A_i$ (1 is a unit matrix) and $\Pi = -(1-A_1 - \ldots -A_k)$ are coefficient matrices, k denotes the lag length, and θ is a constant. The rank of the matrix Π is equal to the number of independent cointegrating vectors which are defined as:

$\Pi = \alpha\beta^1$

where α denotes the matrix of the speed of the cointegrating vector adjustment to the long run equilibrium and β represents the 4 x r matrices of parameters of the long-run cointegrating vector. Two likelihood ratio (LR) test statistics that are used to determine the number of unique cointegrating vector in Y_t are derived using vectors. v_{0t} and v_{it}, known as trace and maximal eigenvalue tests.

3.1 Error Correction Model (ECM), Granger Causality and Innovation Accounting

Given the assumption that IPI is determined to be independent of contemporaneous movements in macro-variables in the country, this is not as restrictive as it may seem for it allows full dynamics. Therefore, the unrestricted vector autoregressive (VAR) system can be written as follows:

$$\Delta IPI_t = \alpha_{10} + \sum_{i=1}^{p} y_{1i}\, \Delta IPI_{t-1} + \sum_{i=1}^{p}{}_{1,i}\, \Delta EX_{t-i} + \sum_{i=1}^{p} \delta_{1,i}\, \Delta INF_{t-i} + \sum_{i=1}^{p}{}_{1i}\, \Delta MS_{t-1i} + \varepsilon_{1t} \quad (1)$$

$$\Delta EX_t = \alpha_{20} + \sum_{i=1}^{p} y_{2i}\, \Delta IPI_{t-1} + \sum_{i=1}^{p}{}_{2,i}\, \Delta EX_{t-i} + \sum_{i=1}^{p} \delta_{2,i}\, \Delta INF_{t-i} + \sum_{i=1}^{p}{}_{2i}\, \Delta MS_{t-1i} + \varepsilon_{2t} \quad (2)$$

$$\Delta INF_t = \alpha_{30} + \sum_{i=1}^{p} y_{3i}\, \Delta IPI_{t-1} + \sum_{i=1}^{p}{}_{3,i}\, \Delta EX_{t-i} + \sum_{i=1}^{p} \delta_{3i}\, \Delta INF_{t-i} + \sum_{i=1}^{p}{}_{3i}\, \Delta MS_{t-1i} + \varepsilon_{3t} \quad (3)$$

$$\Delta MS_t = 4 + \sum_{i=1}^{p} y_{4i}\, \Delta IPI_{t-1} + \sum_{i=1}^{p}{}_{4,i}\, \Delta EX_{t-i} + \sum_{i=1}^{p} \delta_{4,i}\, \Delta INF_{t-i} + \sum_{i=1}^{p}{}_{4i}\, \Delta MS_{t-1i} + \varepsilon_{4t} \quad (4)$$

As pointed out by Kim and Seo (2003), contemporaneous restriction for which no identification is guaranteed often leads to invalid estimates while the long run identifying assumption restrains the longer-run dynamics in the absence of any economic theory that describes an equilibrium relationship.

In the case of cointegrated variables, the error correction model (ECM) is the appropriate method for ascertaining the long run relationships. This takes the form:

$$\Delta IPI_t = \lambda_1 + \sum_{i=1}^{k-1} \Psi_{1,i}\, \Delta IPI_{t-1} + \sum_{i=1}^{k-1}{}_{1,i}\, \Delta EX_{t-i} + \sum_{i=1}^{k-1} \Gamma_{1,i}\, \Delta INF_{t-i} + \sum_{i=1}^{k-1}{}_{1,i}\, \Delta MS_{t-1i} + \mu_1 ECT_{t-1} + \varepsilon_{1t} \quad (5)$$

$$\Delta EX_t = \lambda_2 + \sum_{i=1}^{k-1} \Psi_{2,i}\, \Delta IPI_{t-1} + \sum_{i=1}^{k-1}{}_{2,i}\, \Delta EX_{t-i} + \sum_{i=1}^{k-1} \Gamma_{2,i}\, \Delta INF_{t-i} + \sum_{i=1}^{k-1}{}_{2,i}\, \Delta MS_{t-1i} + \mu_2 ECT_{t-1} + \varepsilon_{2t} \quad (6)$$

$$\Delta INF_t = \lambda_3 + \sum_{i=1}^{k-1} \Psi_{3,i}\, \Delta IPI_{t-1} + \sum_{i=1}^{k-1}{}_{3,i}\, \Delta EX_{t-i} + \sum_{i=1}^{k-1} \Gamma_{3,i}\, \Delta INF_{t-i} + \sum_{i=1}^{k-1}{}_{3,i}\, \Delta MS_{t-1i} + \mu_3 ECT_{t-1} + \varepsilon_{3t} \quad (7)$$

$$\Delta MS_t = \lambda_4 + \sum_{i=1}^{k-1} \Psi_{4,i}\, \Delta IPI_{t-1} + \sum_{i=1}^{k-1}{}_{4,i}\, \Delta EX_{t-i} + \sum_{i=1}^{k-1} \Gamma_{4,i}\, \Delta INF_{t-i} + \sum_{i=1}^{k-1}{}_{4,i}\, \Delta MS_{t-1i} + \mu_4 ECT_{t-1} + \varepsilon_{4t} \quad (8)$$

The coefficient of the ECT_{t-1} term indicates long run causality, while the joint *F*-test of the coefficients of the first differenced independent variables indicates short-run causality. The causality can be derived through the Wald test of the joint significance of the lags of the independent variables.

Finally, in order to investigate the dynamic relationship among economic variable, innovation, accounting (variance decomposition and impulse response function) technique can be used.

3.2 Data and Sources

Quarterly data that cover the sample period 1970 to 2010 were used in the study. The variables are industrial production index (IPI), money supply (MS), inflation rate (INF) and real exchange rate (EX). The data were sourced from the Central Bank of Nigeria, Statistical Bulletin, 2011 edition. The variables were transformed to natural logarithm in order to minimize the scale effect. The descriptive statistics of the variables are as shown in Table 1.

Table 1
Descriptive Statistics

	IPI	EX	INF	MS
Mean	98.26987	67.27846	93.68242	3137168
Median	96.69250	21.99650	88.82150	501462.8
Maximum	125.9000	149.5800	248.1000	1.15E+08
Minimum	58.18400	1.010000	3.162000	26110.00
Std. Dev.	14.24912	56.69972	76.26477	11718841
Skewness	-0.438057	0.155041	0.334730	8.901636
Kurtosis	3.243650	1.196284	1.800645	85.50126
Jarque-Bera	3.445585	13.95643	7.860952	29680.89
Probability	0.178567	0.000932	0.019634	0.000000
Sum	9826.987	6727.846	9368.242	3.14E+08
Sum Sq. dev.	20100.71	318271.0	575815.2	1.36E+16
Observations	100	100	100	100

The descriptive statistics of the variables as summarized in table 1 show that all variables except industrial production (IPI) are positively skewed. This means that they have long right tail. However, from the kurtosis statistic, the table shows that the distribution of exchange rate and inflation is flat relative to normal as their kurtosis is less than 3. The other variables namely industrial production and money supply are peaked relative to the normal with kurtosis exceeding 3.

4. EMPIRICAL RESULTS

4.1 Estimation Techniques and Presentation of Estimation

First, we look at the correlation among the variables under consideration. The results are as shown in Table 2.

Table 2
Correlation Matix

	EX	INF	MS	IPI
EX	1.000000			
INF	0.931232	1.000000		
MS	0.324634	0.396375	1.000000	
IPI	0.783894	0.805591	0.376570	1.000000

The results show that industrial production is positively correlated with other variables. The results show that other variables are positively correlated with one another. The correlation coefficient between IPI and exchange rate is very high above 70%.

4.2 Unit Root Test

The results of the unit root tests using both ADF and KPSS are as shown in Table 3. The results show that all the variables are integrated of order one, I (1).

Table 3
Unit Root Tests

Series	ADF		KPSS	
	Level	1st Difference	Level	1st Difference
ln IPI (Constant)	-9.017394	-7.465252	0.208882	0.025908
(constant and linear)	-10.79489	-10.79489	0.123181	0.025918
ln EX (Constant)	-0.955229	-4.467299	1.664851	0.043071
(constant and linear)	-2.951170	-4.487967	0.275623	0.044201
ln INF (Constant)	-2.218150	-3.566412	1.936057	0.475540
(constant and linear)	-1.059578	-4.149335	0.476666	0.075906
ln MS (Constant)	1.426817	-1.965867	2.100304	0.330188
(constant and linear)	-1.326298	-2.035486	0.101772	0.122104

Having established that the variables are I (1), we then applied the Johansen –Juselius (1990) cointegration technique to determine whether there is at least one linear combination of these variable that is i (0). The results of λ-max and the trace tests are as shown Table 4.

Table 4
Nigeria: Johansen Co-integration Test (with a Linear Trend) where is the Number of Cointegrating Vectors

Null	Alternative r	λ - max	Critical values	Trace	Critical values
0	1	57.419*	27.584	93.482*	47.856
<1	2	30.797*	21.132	36.063*	29.797
<2	3	5.250	14.265	5.267	15.495
<3	4	0.016	3.841	0.016	3.841

Note. Critical values at 95% level, *t* ratios are in parentheses

The results in Table 4 show that the null hypothesis of no cointegration, i.e. 0, can be rejected using the maximum eigen value or trace test statistic. They are both greater than their critical values in the case of the trace and maximum eigen value tests. In the same way, the null hypothesis of one cointegration (r = 1) can be rejected using the maximum eigen value or trace test statistics. The implication of the existence of cointegration is that any one variable can be targeted as a policy variable to bring about the desired changes in other variables in the system. Also, the existence of cointegration implies the existence of long term causality. However, the direction of causality is not yet clear.

4.2 Results from Vector Error Correction Model

The results of the estimated vector error correction model, using an optimal lag structure of two is as shown in Table 5 in estimation.

Table 5
Vector Error Correction Estimates

Equation	ΔIPI	ΔEX	ΔINF	ΔMS
Ecm	-0.152940 (-1.96822)	0.061141 (2.06643)	-0.000187 (-2.02898)	-556.3080 (-6.72846)
ΔIPI_{-1}	-0.578541 (-5.26959)	-0.070710 (-1.69146)	0.000107 (0.82352)	304.2251 (2.60427)
ΔIPI_{-2}	-0.306069 (-3.00581)	-0.039922 (-1.02965)	5.58E-05 (0.46149)	79.76340 (0.73620)
ΔEX_{-1}	0.272029 (0.81135)	-0.174224 (-1.36472)	0.000343 (0.86116)	1223.450 (3.42950)
ΔEX_{-2}	0.341009 (1.01253)	0.104305 (0.81337)	0.000105 (0.26345)	1525.430 (4.25682)
ΔINF_{-1}	-22.58071 (-0.26767)	-27.49474 (-0.85595)	0.342397 (3.41777)	-33878.22 (-0.37742)
ΔINF_{-2}	9.169374 (0.10992)	38.91365 (1.22508)	-0.321556 (-3.24590)	114839.3 (1.29379)
ΔMS_{-1}	-0.003168 (-0.93664)	-0.000703 (-0.54584)	-9.21E-06 (-2.29249)	-8.936983 (-2.48347)
ΔMS_{-2}	-0.002680 (-0.82359)	0.001540 (1.24325)	2.36E-06 (0.61131)	-13.37016 (-3.86212)
C	475.6894 (0.47116)	217.869 (0.56659)	3069788 (2.56037)	2511362 (2.33775)
R^{-2}	0.362148	0.171776	0.238437	0.361746
***F*-statistic**	5.488364	2.004893	3.026523	5.478824
Likelihood	-1007.983	-914.3236	-354.6031	-1684.055
AIC	20.98934	19.05822	7.517589	34.92897

The error correction term are of correct sign and are significant for all the equations except for exchange rate. This further suggests that there is channel of causation among the variables. The summary of the direction of causality is as shown in Table 6.

Table 6
Nigeria: Block Exogeneity Wald Test

Variables	ΔIPI	ΔEX	ΔINF	ΔMS	Joint
ΔIPI	-	1.17	0.06	1.29	1.66
ΔEX	2.99	-	1.83	2.05	7.40
ΔINF	0.63	0.76	-	6.07*	6.70
ΔMS	7.16*	22.12*	1.68	-	26.12*

Note. Denote significant at 5% level.

The results in Table 6 show that exchange rate, inflation and money supply do not cause industrial production in the short run. In the same way, industrial production, inflation and money supply do not cause exchange rate in the short run. In the inflation equation, both industrial production and exchange rate are statistically insignificant, implying the two do not cause inflation in the short run, however there is unidirectional causality running from money supply to inflation. In the money supply equation, the results show that in the long run, industrial production, exchange rate and inflation cause money supply. In the short run, there is unidirectional causality running from both industrial production and exchange rate to money supply.

As has been pointed out in the literature, individual coefficients from the error-correction model are hard to interpret in the case of vector-auto-regressive model. Consequently, the dynamic properties of the model are analyzed by examining the impulse response functions and the variance decompositions. The impulse response functions trace the dynamic responses to the effect of shock in one variable upon itself and on all other variables i.e. it is a tool that portrays the expected path over time of the variable to shocks in the innovations. These impulse response functions are plotted in Figure 2.

As shown in Figure 2, a one standard deviation shock applied to exchange produces no effect on industrial production throughout the period. What this seems to suggest is that there is no evidence in support of negative or positive effect of exchange rate on industrial production in Nigeria. One possible reason for this could be low industrial production activity in Nigeria over the years.

A one standard deviation shock to inflation has no perceptible effect on industrial production in the short and medium terms but causes output to decrease in the long run. A one standard deviation shock to money supply has no effect on industrial production in the short run. However, the effect becomes noticeable in the long run. First, it reduces industrial output but afterwards a significant positive effect on industrial output.

As impulse response functions will not show the magnitude of the effect of the variables on industrial production, we therefore analyze the variance decompositions. The VDCs indicate the proportion of the forecast error in a given variable that is accounted for by innovations in each endogenous variable. The results of the variance decompositions are as shown in table 7. It shows that money supply had a large impact on industrial production both in the short run and long run. In fact, except for the first period, money supply accounts of 96 per cent of the variation in industrial production. The results show that other variables namely exchange rate and inflation had no significant impact on industrial production. The proportions explained by these variables (inflation and exchange rate) are very low.

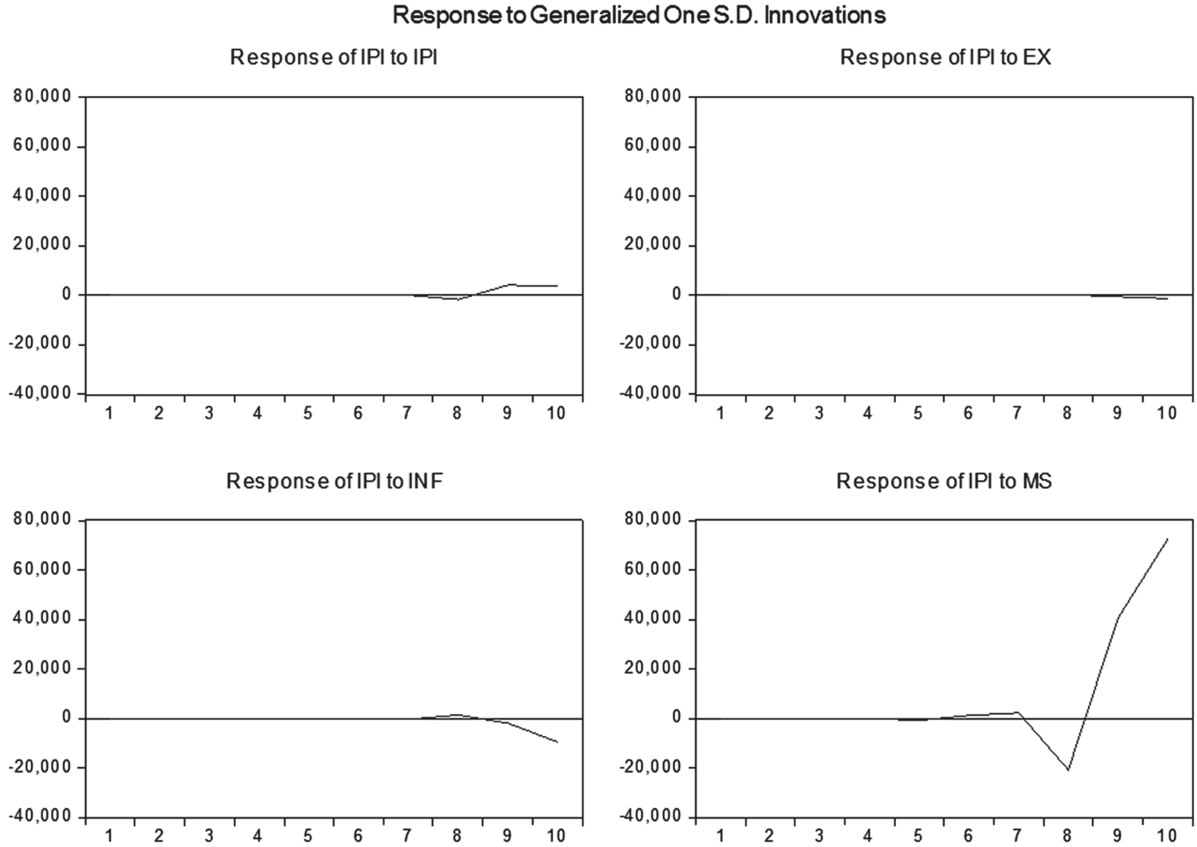

Figure 2
Plot of the Impulse Response Function

Table 7
Variance Decomposition of IPI

S.E.	IPI	ER	INF	MS
8325.183	100.0000	0.000000	0.000000	0.000000
16627.49	32.27375	0.145882	0.760179	66.82019
34863.94	7.378278	0.920925	0.885282	90.81551
37419.56	6.411919	1.495219	2.971120	89.12174
335954.5	2.185400	0.396570	1.694506	95.72352
1079205.	1.182714	0.909764	1.038252	96.86927
1195174.	1.042116	2.501481	1.038182	95.41822
7849842.	2.119910	0.290162	1.988364	95.60156
32092181	1.364758	0.754538	1.189502	96.69120
48606960	0.750922	1.869870	0.595344	96.78387

However, in view of the fact that the estimated results can be sensitive to ordering of the variables, we re-estimated the model by reversing the order of the first and the last variables to check for robustness. The results obtained were not significantly different from the one reported here.

CONCLUSIONS

The paper examined the impact of exchange rate on industrial production in Nigeria over the period 1986-2010. Our main findings were as follows: first, the four variables namely industrial production, exchange rate, inflation and money supply tend to move together in the long run. Second, exchange rate had no perceptible impact on industrial production in the short run. However, the effect is positive in the long run. Third, impulse response functions and variance decompositions analyses showed that money supply had significant impact on industrial production.

The main implications of the findings are: one, increased access to exchange rate for production could have significant impact on industrial production in the long run. This, therefore, suggests that more foreign exchange should be made available to reduce the gap between the supply and demand for exchange rate thereby enhancing the value of the domestic currency. Two, increased money supply into industrial sector would have significant effect on industrial production in Nigeria. This simply means that increased credit allocation to the sector will positively impact output in the subsector.

REFERENCES

Dickey, D. A., & Fuller, W. A. (1979). Distribution of the estimators for autoregressive time series with a unit root. *The American Statistical Association*, *74*, 427-431.

Edwards, S. (1986). Are devaluation contractionary? *The Review of Economics and Statistics*, *68*(3), 501-508

Johansen, S., & Juselius, K. (1990). Maximum likelihood estimation and inference on cointegration with application to the demand for money, *Oxford Bulletin of Economics and Statistics*, *52*, 169-210.

Kamin, S. B., & Klau, M. (1998). Some multi-country evidence on the effects of real exchange rates on output. *International Finance discussion papers*, *611*, 1-18.

Kim, D. & Seo, J. (2003). Does FDI inflow crowd out domestic investment in Korea? *Economic Studies*, *30*(6), 605-622.

Kwaitowski, D., Phillips, P. C. B., Schmidt, P., & Shin, Y. (1992). Testing the null hypothesis of stationarity against the alternative of a unit root: How sure are we that economic time series have a unit root. *Econometrics*, *54*, 159-178.

Rogers, J. H., & Wang, P. (1995). Real exchange rate movements in high inflation countries. *International Finance Discussion Papers*, *501*, 1-43.

Sheeley, C. A. (1986). Unanticipated inflation, devaluation and output in Latin America. *World Development*, *14*(5), 665-671.

Terence, C. M., & Pentecost, E. J. (2001). The real exchange rate and the output response in four EU accession countries. *Emerging Markets Review*, *2*(4), 418-430.

Vo. T. T., Dinh, H. M., Do, X. T., Hoang, V.T. & Phan, C. Q. (2000). *Exchange rate arrangement in Vietnam: information content and policy options*. Individual Research Project, East Asian Development Network (EADN).

