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## A PRAGMATIC OVERVIEW OF THE IMPACT OF EXCHANGE RATE ON INDUSTRIAL PRODUCTIVITY IN NIGERIA

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**Abstract:** *The study examined the impact of exchange rate on industrial productivity of Nigeria's from 1980 to 2013. The empirical analysis revealed that there is a long-term relationship between the dependent and independent variables, showing positive autocorrelation. Exchange rate and government expenditure from the findings had a negative effect or impact on industrial productivity, whereas labour force and gross capital formation both had a positive effect on industrial productivity. The study revealed that the F-statistic ( $F_{cal}$ ) is greater than the critical value at 5% level of significance, and so the null hypothesis ( $H_0$ ) was rejected in favour of the alternate hypothesis that the variables are jointly statistically significant. To test for autocorrelation (AC), we make use of the Amended Durbin-Watson Statistic which result revealed that there is positive autocorrelation since  $dU > d < 4 - dU$  is equal to  $1.8076 > 1.307127 < 2.1924$ . The study further revealed that Exchange rate and government expenditure had a negative effect or impact on industrial productivity, whereas labour force and gross capital formation both had a positive effect on industrial productivity. Based on the findings the following recommendations are made to control exchange rate from fluctuating. Government should create incentive such as loan subsidy etc to small scale industries, thereby encouraging them to process domestic goods into processed goods for export. The government should encourage and promote export in order to maintain a surplus balance of trade. Effective fiscal and monetary policies should be put in place to bring about a realistic exchange rate for the naira. An appropriate environment and infrastructural facilities that will encourage industries to come in should be provided so that foreign investors will be attracted to invest in Nigeria thereby creating job opportunities. Finally, the government should influence the foreign exchange rate, through positive economic reforms that will reduce the adverse effect of unstable foreign exchange rate on the Nigerian economy.*

**Keywords:** Industrial Productivity, Government Expenditure, Auto Correlation (AC), Exchange Rate, Labour Force, Foreign Exchange Rate, Gross Capital, Loan Subsidy, Fiscal, Monetary Policies and Nigeria Economy.

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## INTRODUCTION

In a globalized world today, there is hardly any country who can boast of living in a self-sufficiency economy. The linkage is made possible through trade and the use of foreign currencies i.e. foreign exchange (Owolabi and Adejare, 2012). The exchange rate which is the price of one currency in terms of another currency, (Fagbemi, 2006), is a veritable instrument of economic management and therefore an important macroeconomic indicator used in assessing the overall performance of an economy. Douglas and Jike (2005) noted that movements in exchange rate are known to have ripple effect on other economic variables such as interest rate, inflation rate, unemployment rate, terms of trade, and so on. All of these factors underscore the importance of exchange rate to the economic well-being of every country that deals in international trade of goods and services. Nigeria, like many other low income open economies of the world, has adopted the two main exchange rate regimes for the purpose of gaining internal and external balance of trade. Empirical evidences seem to indicate the growth performance of the industrial sector together with its capacity utilization level has not been encouraging. Through, the share of manufacturing which is a sub-sector of the industrial sector in GDP rose from about 4% in 1977 to a peak of 13% in 1982, but it has since fallen to less than 10% today (Simon-Oke, 2010).

Oladipupo & Onotaniyohuwo (2011) stated that movements in the exchange rate have ripple effects on other economic variables such as interest rate, inflation rate, unemployment, money supply, etc. These facts underscore the importance of exchange rate to the economic well-being of every country that opens its doors to international trade in goods and services. Opaluwa, (2010) opines that following the fluctuations of the naira in 1986, a policy induced by the structural adjustment programme (SAP), the subject of exchange rate fluctuation has become a topical issue in Nigeria. This is because it is the goal of every economy to have a stable exchange rate with its trading partners. This goal was not reached in spite of the fact that the country embarked on devaluation to promote export and stabilize the rate of Exchange. Despite various efforts made by Nigeria to maintain a stable exchange rate, the naira has continue to depreciate from ₦0.61 in 1981 to ₦2.02 in 1986, ₦7.901 in 1990, all against the one US dollar. The policy of guided or managed deregulation pegged the naira at ₦21.886 in 1994, ₦86.322 in 1999 and ₦135.50 in 2004. Thereafter, the exchange rate appreciated to ₦132.15 in 2005 and later ₦118.57 in 2008. Towards the end of the year, the naira depreciated to ₦150.0124 in 2009 and current in 2nd August, 2013 the exchange rate of one US Dollar to naira is ₦160.14756 (or ₦160.15). Early this year precisely, this February 2016, one dollar is exchanged for ₦360.00.

Economists continued to disagree over the ability of exchange rate changes to improve the trade imbalance of developing countries (Hinkle, 1999:21). While some agreed on the ability of such changes to bring about growth, others believed that structural policies bring export led growth in the economy. These issues need to be investigated to ascertain the effectiveness

of exchange rate on industrial productivity or output and to test the long run relationship between exchange rate and industrial productivity in Nigeria.

## REVIEW OF LITERATURE

Exchange rate is the price of one country's currency expressed in terms of some other currency. It determines the relative prices of domestic and foreign goods, as well as the strength of external sector participation in the international trade. Exchange rate has been defined in so many ways either in terms of its roles or function. Lipsey and Steiner (1989) defined exchange rate as the price at which purchase and sale of foreign currency takes place, it is the amount of one currency that must be paid in order to obtain one unit of another currency. Ajayi (1995) defined the exchange rate as the relative price of two assets in one country in terms of another. Exchange rate as an economic indicator plays an increasingly significant role in an economy, as it directly affects domestic price level, profitability of traded goods and services, allocation of resources and investment decision (Ajakaiye, 1994). In fact, exchange fluctuation today is the bed rock for all economic activities across the globe. Douglas and Jike (2005) noted that fluctuation in exchange rate are known to have ripple effect on other economic variable like interest rate, inflation rate, unemployment rate, terms of trade and many more. Therefore these factors underscore the importance of exchange rate to economic productivity of every country that deals in international trade of goods and services.

Exchange rate regime and interest rate remained an important issue of discourse in the International finance as well as in developing nations, with more economies embracing trade liberalization as a requisite for economic growth (Obansa, Okoroafor, Aluko and Millicent, 2013). In Nigeria, exchange rate has changed within the time frame from regulated to deregulated regimes. Ewa, (2011) agreed that the exchange rate of the naira was relatively stable between 1973 and 1979 during the oil boom era and when agricultural products accounted for more than 70% of the nation's gross domestic products (GDP). In 1986 when Federal government adopted Structural Adjustment Policy (SAP) the country moved from a peg regime to a flexible exchange rate regime where exchange rate is left completely to be determined by market forces but rather the prevailing system is the managed float whereby monetary authorities intervene periodically in the foreign exchange market in order to attain some strategic objectives (Mordji, 2006). This inconsistency in policies and lack of continuity in exchange rate policies aggregated unstable nature of the naira rate (Gbosi, 2005). Benson and Victor, (2012) and Aliyu, (2011) noted that despite various efforts by the government to maintain a stable exchange rate, the naira has depreciated throughout the 80's to date.

### Exchange Rate Policy in Nigeria

Exchange rate regimes are the free floating, rigidly fixed exchange rate system and the hybrid systems. The Hybrid system is the resultant variants arising from the combination of the two

extreme exchange rate regimes since in real life, a free floating or a rigidly fixed regime is impracticable. It is difficult to define a system that might be effective and optimal at all times. While a fixed regime guarantees stability in decision-making process, a flexible system tends to be volatile and unstable, although it tends to transmit external shocks across borders. However, a floating rate does not on its own guarantee the prevention of external shock to the domestic economy; and neither is it necessarily self-equilibrating, as recent experiences have shown that reserves are needed for desirable adjustments. Note that the problems associated with fixed and flexible exchange rate regimes usually prompt countries to adopt a combination of the two which is the case of Nigeria, borrowing substantially from the Central Bank of Nigeria Brief (1998).

### **Foreign Exchange in Nigeria**

The evolution of the foreign exchange market in Nigeria up to its present state was influenced by a number of factors such as the changing pattern of international trade, institutional changes in the economy and structural shifts in production, as well as the fixation by Government policies. Before the establishment of the Central Bank of Nigeria (CBN) in 1958 and the enactment of the Exchange Control Act of 1962, foreign exchange was earned by the private sector and held in balances abroad by commercial banks which acted as agents for local exporters. During this period, agricultural exports contributed the bulk of foreign exchange receipts and the Nigerian pound was tied to the British pound sterling at par, with easy convertibility, which delayed the development of an active foreign exchange market. However, with the establishment of the CBN and the subsequent centralization of foreign exchange authority in the Bank, the need to develop a local foreign exchange market became paramount.

The increased export of crude oil in the early 1970s, following the sharp rise in its prices, enhanced official foreign exchange receipts. The foreign exchange market experienced a boom during this period and the management of foreign exchange resources became necessary to ensure that shortages did not arise; not until 1982 that comprehensive exchange controls were applied as a result of the foreign exchange crisis that set in that year. Second - tier Foreign Exchange Market (SFEM) was introduced in September, 1986. Under SFEM, the determination of the Naira exchange rate and allocation of foreign exchange were based on market forces. To enlarge the scope of the Foreign Exchange Market, Bureau de Change was introduced in 1989 for dealing in privately sourced foreign exchange. Volatility in rates with further reforms were introduced in the Foreign Exchange Market in 1994. These included the formal pegging of the naira exchange rate, the centralization of foreign exchange in the CBN, the restriction of Bureau de Change to buy foreign exchange as agents of the CBN, the reaffirmation of the illegality of the parallel market and the discontinuation of open accounts and bills for collection as means of payments sectors. The Foreign Exchange Market was liberalized in 1995 with the introduction of an Autonomous Foreign Exchange Market

(AFEM) for the sale of foreign exchange to end-users by the CBN through selected authorized dealers at market determined exchange rate. In addition, Bureau de Change was once more accorded the status of authorized buyers and sellers of foreign exchange. The Foreign Exchange Market was further liberalized in October, 1999 with the introduction of an Inter-bank Foreign Exchange Market (IFEM).

### **Exchange Rate Regimes in Nigeria**

Exchange rate regimes applied in Nigeria have traversed two main mechanisms namely: the fixed and flexible regimes. Between 1960 and 1986, the fixed exchange rate system was in operation. The inability of the system to achieve the major objectives of exchange rate policy led to the reversal of policy in September 1986 with the floatation of the Naira under the Structural Adjustment Programme (SAP). The flexible system continued until January 1994 when the fixed exchange rate system was reintroduced with the pegging of the naira relative to the United States' dollar. In 1995, the exchange rate mechanism was deregulated with the adoption of the Autonomous Foreign Exchange Market (AFEM). From 1962 to 1973, the Nigerian currency was pegged to the pound sterling on a 1:1 ratio before the latter was devalued by 10%. Thereafter, the currency was allowed to move independently of the sterling. Also, the Naira was appreciated progressively to source imports cheaply to implement development projects. This enhanced the reliance on imports, which eventually led to the depletion of external reserves. By 1981, there was a gradual depreciation of the naira against the United States' dollar and/or the pound sterling based on whichever, was stronger. This gradual depreciation policy, however, could not sufficiently reverse the sustained pressure on the external sector. In 1978, the CBN applied the basket-of-currencies approach as a guide in determining the exchange rate movement. The exchange rate during this periods was determined by the relative strengthen of the currencies of the country's trading partners and the volume of trade with such countries. Weights were assigned to countries' currencies with the dollar and sterling dominating in the exchange rate calculation.

### **The Dual Exchange Rate System Era**

With the introduction of the Structural Adjustment Programme (SAP) in 1986, a flexible exchange rate mechanism was adopted with the floating of the naira in the Second-tier system; the exchange rate was largely determined by market forces. Although these forces were expected to produce a clearing price as the basis for the allocation of foreign exchange, the monetary authorities still had the power to intervene in the market when necessary. Such intervention depends on the state of the balance of payments, the rate of inflation, domestic liquidity, and the employment situation. Within the basic framework of market determination of the naira exchange rate, various methods have been applied and some adjustments carried out to fine-tune the system. At the commencement of the SFEM, a dual exchange rate for the allocation of foreign exchange was adopted. Pre-SFEM or transitional transactions, debt service payments, contributions to international organizations, and

expenses of Nigerian embassies were excluded from the SFEM and settled at the first-tier rate. The second-tier rate was determined by auction at the SFEM. At the first two sessions of the SFEM, the average of successful bids of authorized dealers was used to determine the exchange rate. Allocations were made to banks on pre-determined quota basis. Owing to the downward trend of the nominal exchange rate, the average pricing method was abandoned in the auction and replaced by marginal rate. Later, the Dutch Auction System (DAS) was adopted in April 1987, with an aim of introducing professionalism. Under the DAS, individual bank bid rates were used to allocate foreign exchange. The system, however, created the problem of multiplicity of rates, which resulted in the further depreciation of the naira.

### **The Unified Exchange Rate System**

In July 1987, the first and second-tier markets were merged into an enlarged Foreign Exchange Market (FEM). Under FEM all transactions were subjected to market forces. The merger increased demand pressures and contributed to the persistent depreciation of the naira between July and November 1987. In 1988, the inter-bank market where banks were allowed to transact official foreign exchange business among them was separated from the official market. Subsequently, an autonomous market for privately sourced foreign exchange emerged with its interdependent rates. The autonomous market rates depreciated continuously, necessitating its subsequent merger with the FEM to form the Inter-bank Foreign Exchange Market (IFEM) in January 1989. The exchange rate in this market premium was reduced substantially. The exchange rate under IFEM was determined through one or more of the following methods: marginal rate pricing, average rate pricing, highest and lowest bids, weighted average pricing, average of successful bids and consideration of developments in the exchange rate of major international currencies. To further reduce exchange rate instability, the CBN modified the inter-bank procedures in December 1990 when the DAS was re-introduced. In August 1991, the modal weighted average method of exchange rate determination was introduced. Under the new system, the rates tending towards the mode were applied to determine the market exchange rate. This method was designed to reduce wide fluctuations in the exchange rate.

### **Completely Deregulated Exchange Rate System**

The parallel market premium was becoming increasingly high, reaching 79.2% in February 1992, compared with 20.0% in 1990 and 35.5% in 1991, as against the conventional limit of 5.0%. As a result of the persistent instability in the foreign exchange market, the CBN adopted a completely deregulated system of foreign exchange trading on March 5, 1992. Under the new arrangement, the CBN bought and sold foreign exchange actively in the market and was also expected to supply in full all requests for foreign exchange made by the authorized dealers. The aim of this new mechanism was to narrow the parallel market premium and enhance the operational and allocative efficiency of the foreign exchange market. In pursuance of these objectives, the CBN adjusted its effective rate upward on March

5, 1992. The upward adjustment of the official exchange rate reduced the parallel market premium. For a limited period, the parallel market premium declined gradually while effective demand by banks for foreign exchange fell short of the supply. However, as a result of renewed demand pressures and speculative activities, the parallel market premium started to widen again. In 1993, the naira exchange rate was administered at N21.9960 to the dollar throughout the latter part of the year. However, the rates in the parallel market and the bureaux de change almost doubled the rate at the official market.

### **Reintroduction of the Fixed Exchange Rate System**

Given the ailing nature of the economy and the need for its recovery as well as the role of an appropriate exchange rate in the recovery bid, new broad policies to stabilize and shore-up the value of the Naira were delineated by the Federal Government in 1994. And among other policy measures, the naira exchange rate was retained at N 21.9960 to the United States' dollar. The policy stance in 1994 was aimed at instilling sanity into the foreign exchange market and encouraging increased activities in the productive sectors of the economy. It was also expected that complementary monetary policy could reduce the cost of funds to the manufacturing sector, thereby enhancing domestic production and dampening inflation.

### **OVERVIEW OF NIGERIAN INDUSTRIAL POLICY**

Industrial policy can be defined as a systematic government involvement, through specifically designed policies in industrial affairs, arising from the inadequacy of macroeconomic policies in regulating the growth of industry. Instruments of industrial policy include subsidies, tax incentives, export promotion, government procurement, and import restrictions. Other policies such as direct government investment or nationalization of foreign investment formed the core of industrial policy from the 1970s to 1986. However, macroeconomic policies such as exchange rate, monetary policy, trade policies, still shape investment decisions. The development of the Nigerian industrial policy involved through two key stages. They are as follows:

a) The first period (1970 – 1985) covers the state-led import substitution industrialization strategy. The main focus is on the economic role of government through direct investments, administration of a protectionist trade regime, and the introduction of schemes such as indigenisation and preferential credit to nurture indigenous entrepreneurs (Adekoya, 1987). It is argued that the roles assumed by the government, gave it a leadership role in the economy and direct control over the welfare of individual private businesses. The government's strategy during this period simply involved attracting and encouraging foreign capital to engage in manufacturing activities. The role of the government was limited to providing infrastructure and other public utilities, as well as administering industrial incentives. Immediately after the civil war, a new approach became manifest. The Nigerian government emerged with a new nationalistic vigour. This was embodied in the Second

National Development Plan. The government would now pursue a policy of progressive elimination of foreign dominance, both in terms of ownership, management and technical control. To this effect the Nigerian Enterprise Promotion Decree was enacted. Government investments would no longer be limited to public utilities and dying industries, but would be directed into other dynamic sectors.

The government increased its participation in industry through new investments and nationalization of some categories of foreign-owned businesses. Expansion of agro-industry, petroleum and petrochemicals, diversification of the textile industry, development of iron and steel industry, car assembly plants and export oriented industry were top of the list. This new strategy was encouraged and facilitated by the 1973 – 1975 ‘oil boom’, which saw government’s total revenue increase by 500% in just one year.

b) The second period (1986 – Present) lays emphasis on the economic liberalization policies that replaced the state-led import substitution industrialization strategy and nationalization policy (Adekoya, 1987). Government’s policy in this period focuses on privatization, deregulation of foreign investments, trade liberalisation, deregulation of credit policy and the introduction of the Foreign Exchange Market (FEM). Privatisation and deregulation has resulted in the reliance of market, rather than state regulation, and is reducing the role and power of government relative to the private sector. Economic liberalization was also introduced in Nigeria as part of the Structural Adjustment Programme (SAP). Environmental constraints to development are acutely felt in the industrial sector in relation to both production and consumption of manufactured goods. While most problems arising from the consequences for the environment of the consumption of industrial products are an economy-wide concern, environmental effects of industrial production fall within the purview of the industrial sector alone. Here the key to solving many of the problems lies in technology. Since environmental problems caused by industrial production are due to so-called external effects – outside the realm of the market mechanism – corrective policy measures are needed to reduce or eliminate such effects. The response of industry to such policies is in almost all cases of a technological nature. Hence industrial technology and its continuous innovative change – if properly shaped by market and policy incentives – makes an important contribution to solving the environmental sustainability problem.

### **The Concept and Measurement of Productivity**

Enterprises produce goods and services for sale with the aim of making returns on their investments. Productivity has been defined by Economists as the ratio of output to input in a given period of time. In other words, it is the amount of output produced by each unit of input. Business Managers, on the other hand, see productivity not only as a measure of efficiency, but also connotes effectiveness and performance of individual organisations. For them, productivity would incorporate quality of output, workmanship, adherence to standards, absence of complaints, customer satisfaction, etc (Udo-Aka, 1983). Productivity



can be computed for a firm, industrial group, the entire industrial sector or the economy as a whole. It measures the level of efficiency at which scarce resources are being utilized. Higher or increasing productivity will, therefore, mean either getting more output with the same level of input or the same level of output with less input.

Total-Factor Productivity: This is the ratio of output to the aggregate measure of the inputs of all the factors of production. Theoretically, this is the true measure of productivity as it incorporates the contribution of all the factor inputs. The productivity of labour can be measured either as output per operator or output per man-hour, expressed in money value (economic productivity) or in quantities (physical productivity). Because of the heterogeneity of output, it is more usually expressed in value terms which, for the manufacturing sub-sector, are easily calculated from ex-factory prices of finished products, estimated value of semi-finished products and other works and services of an industrial nature. When productivity is measured in physical units, the following formulae can be used to calculate productivity index:

$$X_t = \frac{Q_t}{Q_o} \div \frac{L_t}{L_o}$$

Given that:  $X_t$  = Productivity index

$Q$  = Output in physical units

$L$  = Labour input

$t$  and  $o$  are current and base periods, respectively. If the value of output is used to measure productivity the following formula is used:

$$X_t = \frac{p_o Q_T}{P_U Q_O} \div \frac{L_t}{L_o}$$

Where  $P_o$  is the base period of output.

### **Empirical Literature**

Perhaps owing to the complexities involved in constructing productivity index, there is little or no data on productivity levels in the Nigerian economy in general and the manufacturing sector in particular. Alao (2010) evaluated the productivity of Nigerian manufacturing sector using the Error Correction Model (ECM) and found that interest rate spread and exchange rates have negative impact on the growth of manufacturing sub-sector in Nigeria. He also found out that the rising index of manufacturing sub-sector is a reflection of high inflation rate and cannot be interpreted to mean a real growth in the sector. His findings further revealed that liberalization of the Nigerian economy has promoted manufacturing growth between 1979 and 2008. Ad hoc studies conducted during 1989 indicated that, on the average, there was little rise in productivity (Akinlo, 1996). In Oshoba's study (1989) on food and basic metal industries, only 30 per cent of respondents indicated they had rising productivity. About 11 per cent recorded no growth, while more than half, 57 per cent, recorded declining productivity levels. In the same vein, the Manufacturers Association of

Nigeria (MAN) confirmed that the general trend in productivity in industry was negative in 1989. Indications are that the situation has worsened since then.

In the absence of data on productivity in the sub-sector, data on other indicators of performance can be reviewed. These include manufacturing production annual growth rate, capacity utilization rate and the sub-sectors' share in the gross domestic product (GDP). The growth rate in the sub-sector was relatively high in the period 1966-75 at an annual average of 12.9 per cent. This reflected the importance which the government attached to manufacturing activities and the adoption of import substitution industrialisation strategy from independence which resulted in the establishment of many consumer goods industries, including soft drinks, cement, paints, soap and detergents. Growth in the sector expanded in the period 1976-85 with the establishment of more import substitution industries, with an annual average growth of 18.5 per cent. The oil boom of the era which provided enough foreign exchange for the importation of needed inputs – raw materials, spare parts and machinery – provided the impetus for this phenomenal growth. However, with the collapse of the world oil market from the early 1980s and drastically reduced foreign exchange earning capacity, the sub-sector was no longer able to import needed inputs. Hence, manufacturing output growth fell drastically to an annual average of about 2.6 per cent during the period 1986-98, even with the introduction of SAP in 1986. In fact, for the period 1993-98, growth in the sub-sector was negative. Capacity utilization rate followed the same downward trend, from an annual average of 53.6 per cent in the period 1981-85 to 41.1, 35.4 and 31.8 per cent during the periods 1986-90, 1991-95 and 1996-98. It however rose to 40.42 between the period 1999 and 2003. In addition, the sectors' share in the gross domestic product fell persistently, from 9.2 per cent in 1981-85 to 8.3 per cent for period 1986-90, 7.5 per cent in 1991-95 and 6.3 per cent in 1996-98 (CBN, 2003).

These negative trends in the performance of manufacturing production cannot but indicate falling productivity. The average growth of 2.6 per cent during the SAP period fell short of the expected rate of at least 8 per cent needed to put the sector on the path of recovery. Its stunted growth constrained the capacity of the reform process to pull the economy out of profitable operations estimated at about 50 per cent. Its share of about 6 per cent of GDP is also poor when compared with between 20 and 40 per cent in many industrialised and industrialising nations. Worst still, it is not encouraging when it is recognised that over 60 per cent of the nation's foreign exchange earnings is allocated to a sub-sector that contributes only about 6 per cent of the GDP. Ku et al (2010) noted that in the 1960s and 1970s after the country's independence, the Nigerian manufacturing sector had been developing positively as a result of direct foreign investment. They revealed that the foreign companies had introduced new manufacturing technology that saved time and cost, and improved the quality of the products manufactured. However, from the end of 1980s to date, many problems were found that were responsible for low growth and development in

the manufacturing sector. According to them, some of these problems were dependency on oil for income, weak infrastructure, shortage of skilled labour, lack of adequate financial resources, lack of proper management and planning, and so on.

Adeola (2005) identified the most important constraints to productivity growth in Nigeria as (1) the absence of a consistent and long-term strategy for productivity improvement; (2) the extensive dominance of the public sector in the economy, which stifles private sector initiatives and operations; (3) the very weak corporate linkages among the various sectors of the economy – business linkages facilitate innovation, higher productivity through specialization and flexibility in meeting customer needs, and enables economies of scale; (4) the weak linkage between the educational system and the requirements of the economy; and (5) the poor functioning of the labour and capital markets.

## METHOD OF STUDY

In designing this research, we empirically examine the impact of Exchange Rate on Industrial Productivity in Nigeria. We use secondary data collected from the CBN statistical bulletin.

## Model Specification

The model in this research is based on economic development which shows how exchange rate influences industrial productivity in Nigeria. Exchange rate is not the sole determinant of industrial productivity or output. This is because industrial productivity is influenced by several other factors such as government expenditure, labour, credit facilities, infrastructural and climatic condition. The model is presented as thus;

$$INDP = f(EXR, GEXP, LABF, GCF) \quad - \quad - \quad - \quad - \quad - \quad - \quad - \quad (1)$$

WHERE;

INDP	=	Industrial Productivity
EXR	=	Exchange Rate
GEXP	=	Government Expenditure
LABF	=	Labour Force
GCF	=	Gross Capital Formation

The model is estimated using the ordinary least square (OLS) method of analysis, since it is considered the best linear unbiased estimator (BLUE).

In the estimated form the model is expressed as;

Hence we can write the statistical equation for our model as;

$$INDP = \alpha_0 + \alpha_1 EXR + \alpha_2 GEXP + \alpha_3 LABF + \alpha_4 GCF \quad - \quad - \quad - \quad (2)$$

Thus, one can rewrite the above equation into an econometric form by introducing the constant error term. Thus, the new equation will be;

$$\text{LOG}(INDP) = \alpha_0 + \alpha_1 EXR + \alpha_2 \text{LOG}(GEXP) + \alpha_3 \text{LOG}(LABF) + \alpha_4 \text{LOG}(GCF) + e \quad - \quad - \quad (3)$$

$\alpha_0, \alpha_1, \alpha_2, \alpha_3, \alpha_4$  = Parameters

$e$  = Error term

## DATA PRESENTATION AND ANALYSIS

The research work uses the econometric procedure in estimating the impact of Exchange Rate on Industrial Productivity in Nigeria. The Ordinary Least Square (OLS) technique was employed in obtaining the numerical estimates of the coefficients in the equations. The estimation period covers 1980–2013. To ascertain the validity and reliability of the parameter estimates, they are evaluated based on three criteria viz – Economic Apriori Criteria, Statistical Criteria and Econometric Criteria to determine the theoretical appropriateness of the state of the relationships in our specified model. The  $R^2$  or Coefficient of Determination was used to test the explanatory power of our specified model. To have a good fit, the explanatory power of our estimated model will need to range from 0.5 to 1. The Adjusted  $R^2$  was to correct errors that arise from an increase in the number of explanatory variables, and are usually slightly smaller than the  $R^2$ .

### The T-test

The t-test was used to test the statistical significance of the estimated parameters of our specified model based on the use of 5% level of significance. To be acceptable, the calculated t-value of each estimated coefficient must be greater than the tabulated t-value at the 5% level of significance. Mathematically given as

$$t = \frac{b_n}{S(b_n)}$$

### The F-test

The f-test is used to determine the statistical significance or otherwise of the estimated model. The test was conducted subject to  $V_1$  and  $V_2$  degree of freedom where  $V_1 = K - 1$  and  $V_2 = N - K$ . The model will be statistically significant if the calculated f-ratio is greater than the tabulated f-ratio. There are several other tests carried out based on econometric criteria. They include:

- (i) **Multicollinearity Test** assumptions must hold before we can make use of OLS estimation technique. It shows the linear relationship between two or more explanatory variables following the collinearity tests of the variables. The test is to confirm high collinearity among the variables.
- (ii) **Autocorrelation Test:** Another most useful assumption about the random variable is autocorrelation (Gujarati; 2009:413), used to confirm whether the errors corresponding to different observations are serially correlated or not.
- (iii) **Test for Co-Integration:** Econometrically, two variables will co-integrate if they have a long-term or equilibrium relationship between them and provided that the residuals from regressions are stationary or integrated at zero order,  $I(0)$ . The usual t and f

tests are applicable to data involving (non stationary) time series to test for co-integration as a pre-test to avoid spurious regressions situations" (Granger, 1986; 226) as cited in Gujarati and Sangeetha (2007, 841). Engle-Granger (EG) or Augmented Engle-Granger (AEG) test was also used for this analysis. The test that will be employed here is the two-step residual based Engle-Granger test. Other econometric tests include unit root test, normality test, Granger causality test and heteroscedasticity test.

We therefore applied the Augmented Dickey-Fuller (ADF) unit root test on all the data series adopting the 5% critical level of the Dickey-Fuller (DF) critical table values, hence:

Ho:  $\delta=0$  or  $P = 1$  (The variables are non-stationary)

H1:  $\delta \neq 0$  or  $P \neq 1$  (The variables are stationary)

### Decision Rule

Reject Ho if the ADF statistic is more negative than the ADF critical value at 5% level of significance, accept otherwise. Below is a summary of the ADF unit root test results.

**TABLE 1: Unit Root Test for Variables**

VARIABLES	ADF TEST STATISTICS	5% CRITICAL LEVELS	LEVEL OF INTEGRATION
LOG(INDP)	-7.689982	-2.957110	I(1)
EXR	-5.366548	-2.957110	I(1)
LOG(GEXP)	-5.760830	-2.957110	I(1)
LOG(LABF)	-10.81979	-2.957110	I(1)
LOG(GCF)	-3.112799	-2.960411	I(1)

The result show that at 5% critical value, INDP (Industrial productivity), EXR (Exchange rate), GEXP (government expenditure), LABF (Labour force) and GCF (Gross Capital Formation) is stationary at 1<sup>st</sup> difference and are all integrated at order one I(1). This result is expected, since most macroeconomic variables (time-series) data are known to be non-stationary at level form or zero form. Since our variables are non-stationary (i.e. at level form), we go further to carry out co-integration test. The variables have a long-term relationship or equilibrium between them. That is, the variables are co-integrated.

### Cointegration Test

It is expected that regression involving non-stationary time series variables may produce spurious results. Co-integration tests prove that combination of such variables has a long-term equilibrium or relationship.

Hypothesized No. of (EC)s	Eigen Value	Likelihood Ratio	5% Critical Value
None	0.817524	95.75447	69.81889
At most 1	0.595565	41.31805	47.85613
At most 2	0.226598	12.34961	29.79707
At most 3	0.116512	4.127002	15.49471
At most 4	0.005078	0.162923	3.841466

From the above results, it is quite clear that the co-integration test indicates that there is a co-integrating equation at 5% level, thus implying a long-run relationship among the variables.

#### Estimation of Output and Interpretation

Variables	Coefficient	Standard Error	T-Statistic	Probability
EXR	-0.004160	0.005373	-0.774247	0.4451
LOG(GEXP)	-0.029259	0.046936	-0.623381	0.5379
LOG(LABF)	9.218994	1.885155	4.890310	0.0000
LOG(GCF)	0.279860	0.208068	1.345043	0.1890
C	-160.5067	33.05528	-4.855704	0.0000

$$R^2 = 0.959641$$

$$\text{Adjusted } R^2 = 0.954074$$

$$F - \text{Statistic} = 172.3873$$

$$\text{Durbin Watson} = 1.307127$$

$$\text{Prob (F)} = 0.000000$$

A unit change in the level of exchange rate on the average leads to about -0.004160 unit change in INDP (which also indicates a decrease). Also, a unit change in the level of government expenditure on the average leads to about -0.029259 unit change or INDP. Furthermore, a unit change in the level of labour force leads to 9.218994 unit change in INDP. Moreover, a unit change in gross capital formation leads to about 0.279860 unit change INDP. Although they have both positive and negative relationship with industrial productivity or output, they are not statistically significant, except labour force.

#### EVALUATION OF RESULT BASED ON STATISTICAL CRITERIA

- i) **Coefficient of Determination ( $R^2$ ):** The coefficient of determination determines the proportion of the variation in the dependent variable LOG (INDP) which is explained by the variations in the explanatory variables. The value of  $R^2$  which is 0.959641 reveals that only 95.96% of the variation in the industrial productivity INDP is explained jointly by variations in the explanatory or independent variables.

ii) **The Student T-Test:** - This test is used to show the significance of the parameter estimates by comparing the values of the calculated t-statistic and the critical t-values at 5% level of significance. The hypothesis is stated below:

Ho:  $\beta_i = 0$  (the parameters estimated is statistically insignificant)

Hi:  $\beta_i \neq 0$  (the parameters estimated is statistically significant)

The critical value of No tail test is obtained from the student t-table for  $\alpha/2$  level of significance and  $(n-k)$  degrees of freedom (df).

$\alpha = 5\%$

$\alpha/2 = 0.05/2 = 0.025$

k = number of parameters including the intercept in the regression

n = number of observations

**Decision Rule:**

Reject Ho /t/ > + 0.025,  $(n-k)$  and accept otherwise

$n = 34$

$k = 5$

$n - k = 34 - 5 = 29$

$df = t_{0.025,29} = 2.04523$

Variables	T-statistic /t/	Critical value	Decision Rule	Conclusion
Constant	0.774247	2.04523	+ < 2.04523	Statistically not significant
EXR	0.623381	2.04523	+ < 2.04523	Statistically not significant
LOG(GEXP)	4.890310	2.04523	+ > 2.04523	Statistically significant
LOG(LABF)	1.345043	2.04523	+ < 2.04523	Statistically not significant
LOF(GCF)	4.855704	2.04523	+ > 2.04523	Statistically significant

iii) **F-Test:** This test statistic is used to show the joint significance of the parameters. The T-value provides a test of the Ho that the true slope coefficients are simultaneously zero.

That is:

Ho:  $\beta_0 = \beta_1 = \beta_2 = \beta_3 = \beta_4 = 0$

Hi:  $\beta_0 \neq \beta_1 \neq \beta_2 \neq \beta_3 \neq \beta_4 \neq 0$

**Decision Rule:**

If  $F_{cal} > F_{\alpha,(k-1, n-k)}$ , reject Ho, do not reject Ho if otherwise.

Where  $F_{\alpha,(k-1, n-k)}$  is the critical F - value at the chosen level of significance ( $\alpha$ ) and  $(k-1)$  degree of freedom (df) for the numerator and  $(n-k)$  degree of freedom (df) for the denominator: k = number of parameters used in the regression.

n = number of observations:  $\alpha = 0.05$

Below is a summary.

F-Statistic	F <sub>0.05, (4,29)</sub>	Decision Rule	Conclusion
172.3873	2.7014	$F_{cal} > 2.7014$	Statistically significant

Since the F-statistic ( $F_{cal}$ ) is greater than the critical value at 5% level of significance, we reject the null hypothesis ( $H_0$ ) and conclude that the variables are jointly statistically significant.

### Test Based on Econometric Criteria

- i. **Multicollinearity Test:** One of the assumptions of the classical linear regression model is that there is no multicollinearity among the regressors included in the regression model. In carrying out this test, a simple rule of thumb is used to search for high pair wise or zero order correlation between any two regressors. According to Gujarati (2004), if the correlation coefficient is in excess of 0.8, then multicollinearity is serious from the correlation matrix table (on the appendix), we can notice that there is the presence of multicollinearity and it is normal and tolerable.
- ii. **Test for autocorrelation:** In testing for auto correlation, the Durbin. Watson d-test will be used. Hence, we compare the established lower limit dL and upper limit, dU of Durbin – Watson based on 5% level of significance and k degrees of freedom. Where k = number of explanatory variables excluding the constant. To test for autocorrelation (AC), we make use of the Amended Durbin–Watson Statistic. The hypothesis is thus stated:  
 $H_0: dU < d < 4 - dU$  - There is no autocorrelation

### Decision Criteria

Accept  $H_0$  if  $dU < d < 4 - dU$  and reject if otherwise.

Where  $dU = 1.8076$

$$dL = 1.1439$$

$$4 - dU = 4 - 1.8076 = 2.1924$$

$$1.8076 > 1.307127 < 2.1924$$

Since  $dU > d < 4 - dU$

i.e.  $1.8076 > 1.307127 < 2.1924$ , we do not accept the  $H_0$  and conclude that there is a positive autocorrelation.

- iii. **Heteroscedasticity Test:** The essence of this test is to see whether the error variance of each observation is constant or not. Non constant variance can cause the estimated model to yield a biased result. White's general heteroscedasticity test in which the residuals follow chi-square ( $\chi^2$ ) distribution with degrees of freedom equal to the number of regressors (excluding the constant) is used.

### Hypothesis Testing

$H_0: \beta_i = 0$  - There is no heteroscedasticity

$H_i: \beta_i \neq 0$  - There is heteroscedasticity



### Decision Rule

Reject  $H_0$  if the computed  $n.R^2 > \chi^2_{tab}$ , do not reject otherwise at 5% level of significance.

The result of the heteroscedasticity test is summarized for each model as follows:

$n$  = number of observations = 34 and  $R^2 = 0.240158$

Therefore,  $n.R^2 = 34(0.240158)$

$$= 8.165365$$

$\chi^2_{tab}$  at 5% level of significance with 10 degrees of freedom (df) gives 18.307 from the chi-square ( $\chi^2$ ) distribution table.

Since  $n.R^2 < \chi^2_{0.05,10}$ , the null hypothesis is accepted and we conclude that the errors in the regression result have constant variance.

### FINDINGS

Exchange rate and government expenditure from the findings had a negative effect or impact on industrial productivity, whereas labour force and gross capital formation both had a positive effect on industrial productivity. In the autocorrelation, we did not accept the null hypothesis. The estimators have constant variance and are well specified. From empirical analysis of this study, it was found that exchange rate is negatively related to industrial productivity or growth.

### CONCLUSION

Having seen that exchange rate have an impact on industrial output or growth, there is needed to maintain a stable exchange rate. Hence with stable exchange rate, it will help to curtail inflation, boost export of domestic commodities and above all, maintains steady growth in the industrial output.

### RECOMMENDATIONS

Sequel to the finding of this study, we specifically made the following policy recommendations to the maintenance of stable exchange rate.

1. The government should create incentive such as loans subsidy etc to small scale industries, thereby encouraging them to process domestic goods into processed goods that will help boost our export.
2. The government should encourage the export promotion strategies in order to maintain a surplus balance of trade.
3. An effective policy should be made based on the fiscal and monetary policies which should be aimed at achieving a realistic exchange rate for naira.
4. An appropriate environment and infrastructural facilities that will encourage industries to come in should be provided so that foreign investors will be attracted to invest in Nigeria. This will provide job, increase income and level of the standard of living of the people.

5. Strict foreign exchange control policies should be adopted in order to help in determination of appropriate exchange rate value. This will go a long way to strengthen the naira.
6. In the case of import, tariffs can be placed to be a very high on imported goods thereby discouraging excess imports.
7. Exchange rate liberalization is also critical in facilitating trade in any economy, we therefore advise the policy makers to ensure that exchange to ensure that exchange rate should be determined by the forces of demand and supply.
8. Finally, the government should influence the foreign exchange rate, by positive economic reforms that will reduce the adverse effect of unstable foreign exchange rate on the Nigerian economy with respect to trade flow.

## REFERENCES

- Harris, R.G. (2001). "Is There a Case for Exchange-Rate-Induced Productivity Changes?" In L. Schembri (Ed.) *Re-Visiting the Case for Flexible Exchange Rates*, Bank of Canada, Ottawa.
- Harris, Richard G. and Samer Kherfi (2000). "Productivity Growth, Convergence, and Trade Specialization in Canadian Manufacturing" Forthcoming in J. Bernstein, R.G. Harris and A. Sharpe (Eds.) *The Canada-U.S. Manufacturing Productivity Gap* and available at <http://www.sfu.ca/~rharris/>
- Harris, R.G. (1998). "Long Term Productivity Issues," in T.J. Courchene and T.A. Wilson (eds.), *Fiscal Targets and Economic Growth*, John Deutsch Institute, Queen's University, Kingston.
- Harris, R.G. (1999). "Determinants of Canadian Productivity Growth: Issues and Prospects", Industry Canada Occasional Papers, available at [www.strategis.ca](http://www.strategis.ca)
- Harris, R.G. (1993). "Exchange Rates and Hysteresis in Trade", in J. Murray (ed.) *The Exchange Rate and the Economy*, Bank of Canada, Ottawa.
- Harris, R.G. (2000). "The New Economy and the Exchange Rate Regime" Presented at a Conference in Honour of Robert Mundell at the John Deutsch Institute for the Study of Economic Policy, Queen's University, May and available at <http://www.sfu.ca/~rharris/>
- Helpman, E. (1999). *General Purpose Technologies*, MIT Press, Cambridge, Mass.
- LaFrance, R. and L. Schembri (2000). "The Exchange Rate, Productivity and the Standard of Living", *Bank of Canada Review*, Winter 1999-2000

Grubel, Herbert G. (1999). *The Case for the Amero: The Merit of Creating a North American Monetary Union*, Fraser Institute, Vancouver, Canada.

Adeoye, B.W and Atanda, A.A. (2012). "Exchange Rate Volatility in Nigeria: Consistency, Persistency and Severity Analyses" *CBN Journal*: 29 – 49.

Akpan, E.O. and Atan, J.A. (2012). "Effects of Exchange Rate Movement on Economic Growth in Nigeria" *CBN Journal for Applied Statistic*:

Asher, O.J. (2012). "The Impact of Exchange Rate Fluctuation on the Nigeria Economic Growth (1980 – 2010)" *Unpublished B.Sc Project* Department of Economics, Caritas University Emene Enugu, Enugu State.

Azeez, B.A.; Kolopo, F.T. and Ajayi, L.B. (2012). "Effect of Exchange Rate Volatility on Macroeconomic Performance in Nigeria" *Interdisciplinary Journal of Contemporary Research in Business* 4(1)

Dada, E.A. and Oyeranti, O.A. (2012). "Exchange Rate and Macroeconomic Aggregates in Nigeria" *Journal of Economics and Sustainable Development*. 3(2)

Ehinomen, C and Oladipo, T.I. (2012). "Exchange Rate Management and the Manufacturing Sector Performance in the Nigerian Economy" *IOSR Journal of Humanities and Social Science* 5(5)

Etta, B.E.; Akpan, O.D. and Etim, R.S. (2011). "Effect of Price and Exchange Rate Fluctuations on Agricultural Exports in Nigeria" *International Journal of Economic Development Research and Investment* 2(1)

Ifionu, P.E. and Ogbuagu, A. (2007). "An Econometric Evaluation of Exchange Rate and External Sector Performance in Nigeria, 1975 – 2005" *The Nigerian Academic forum* 13(2)

Oladipupo, A.O. and Onotaniyohuwo, F.O. (2011). "Impact of Exchange Rate on Balance of Payment in Nigeria" *African Research Review: An international Multidisciplinary Journal, Ethiopia* 5(4), [www.Afrrevjo. Com](http://www.Afrrevjo.Com).

Opaluwa, D.; Umeh, J.C. and Ameh, A.A. (2012). "The Effect of Exchange Rate Fluctuations on the Nigerian Manufacturing sector" *African Journal of Business Management* 4(14).

Owolabi, A.U. and Adegbite, T.A. (2012). "The Effect of Foreign Exchange Regimes on Industrial Growth in Nigeria" *Global Advanced Research Journal of Economic, Accounting and Finance* 1(1).

- Mordji, C.N. (2006). "Challenges of Exchange Rate Volatility in Economic Management in Nigeria." *Bullion* Vol.30, No.3. July - Sept. 2006.
- CBN. (2009). *Statistical Bulletin*. Central Bank of Nigeria.
- Akinlo A.E. and Folorunso, B. (1998). "A Dynamic Specification of Aggregate Demand for Money Function in Nigeria", *Nigerian Journal of Economic and Social Studies*, 41, (2)
- Akinlo, A.E. and Oduola F. (2003). "Assessing the Impact of Nigeria's Naira Depreciation on Output and Inflation", *Applied Economics* (forthcoming).
- Alaofin, Victor (1995). "Structural Adjustment Program and Agricultural Tradeables: The Case of Cocoa Farming in Nigeria", *Economic and Management Series*
- V. Arango, S., and Nadiri, M. 1. (1981). "Demand for Money in Open Economies". *Journal of Monetary Economics*.
- Bahmani-Oskooee, M. and Techaratanachai, A. (2001). "Currency Substitution in Thailand". *Journal of Policy Modeling*, 23.
- Fischer, S. (1998). "The Asian Crisis and the Changing Role of the IMF". *Finance and Development*, June 2-5.
- Goldstein, M. and Khan, M.S. (1976). "Large Versus Small Price Changes in the Demand for Imports". *IMF Staff Papers*, 23.
- Johansen, S., and Juselius, K.,(1990). "Maximum Likelihood Estimation and Inference on Cointegration- with Application to Demand for Money". *Oxford Bulletin of Economics and Statistics*, 52.
- McNown, R., and Wallace, M.S. (1992). "Cointegration Tests of a Long Run Relationship between Money and the Effective Exchange Rate". *Journal of International Money and Finance*, 11.
- Obadan, M.I., (1994). *Real Exchange Rates in Nigeria: A Preliminary Study*. NCEMA Monograph Series 6, 1-76.
- Todaro P. and Stephen C. (2004), (8th Ed): *Problems and Policies (International); The Trade Policy Debate: Export Promotion, Import Substitution, and Economic Integration* New York University and the Population Council).
- Adekoya, A. (1987). *The Role of Government in Promoting Increased Productivity on Nigerian Farms*, Proceeding of the First National Conference on Productivity, National Productivity Centre, 1991.

- Udo-Aka, U. (1983). Measuring Productivity: Issues and Problems in Productivity in Nigeria, Proceedings of a National Conference, Edited by Osoba, A.M.
- Adeola, F.A. (2005). Productivity Performance in Developing Countries: Case Study of Nigeria. *United Nations Industrial Development Organization (UNIDO) Report.*
- Obasan, K.A. & Adediran, O.A. (2010). *The Role of Industrial Sector in the Economic Development of Nigeria. Journal of Management and Society.* Vol. 1, No 2.
- Ku, H., Mustapha, U.M. & Goh, S. (2010). *A Literature Review of Past and Present Performance of Nigerian Manufacturing Sector. Journal of Engineering Manufacture.* Vol. 224, No. 12.
- Alao, R.O. (2010). *Productivity in the Nigerian Manufacturing Sub-Sector: Error Correction Model (ECM). European Journal of Economics, Finance and Administrative Sciences.* Issue 20.
- Ajakaye, J. (1999). *"Entrepreneurship Education and Training in Nigeria: Problems and Prospects in the Informal Sector"*, Paper Presented at National Conference on Entrepreneurship Education in Nigeria Tertiary Institutions, Abuja, Nigeria, March 30-April 1, 1999.