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Long Run Impact of Exchange Rate on Nigeria's Industrial Output

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Abstract: *While many scholars have carried out a lot of research on the impact of exchange rate volatility and price shocks on economic growth, this study departs from previous studies and seeks to provide suggestions for Nigerian policy makers on the attainment of an ideal exchange rate necessary to boost industrialization and industrial output. The economies of all the countries of the world are linked directly or indirectly through asset and goods markets. This linkage is made possible through trade and foreign exchange. The price of foreign currencies in terms of a local currency (i.e. foreign exchange) is therefore important to the understanding of the growth trajectory of all countries of the world. The consequences of substantial misalignments of exchange rates can lead to output contraction and extensive economic hardship. These therefore, bring up the issue of an ideal exchange rate necessary for the achievement of a set of diverse objectives - economic growth, containment of inflation and maintenance of external competiveness. This 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 and eventual economic growth.*

Keywords: *economic growth, external competitiveness, exchange rate, industrial output, Nigeria*

I. Introduction

In macroeconomic management, policy makers must face a trade-off of choosing at most two out of these three policy choices: monetary independence, exchange rate stability, and financial openness. In international finance, this hypothesis is referred to as the *trilemma* or *the impossible trinity* (Aizenman, 2010). History has shown that different international financial systems have attempted to achieve various combinations of two out of the three policy goals. For example, the Gold Standard system guarantees capital mobility and exchange rate stability while the Breton Woods System is interested in monetary autonomy and exchange rate stability. For the fact that both systems guaranteed exchange rate stability demonstrates the importance of stable exchange rates in macroeconomic management.

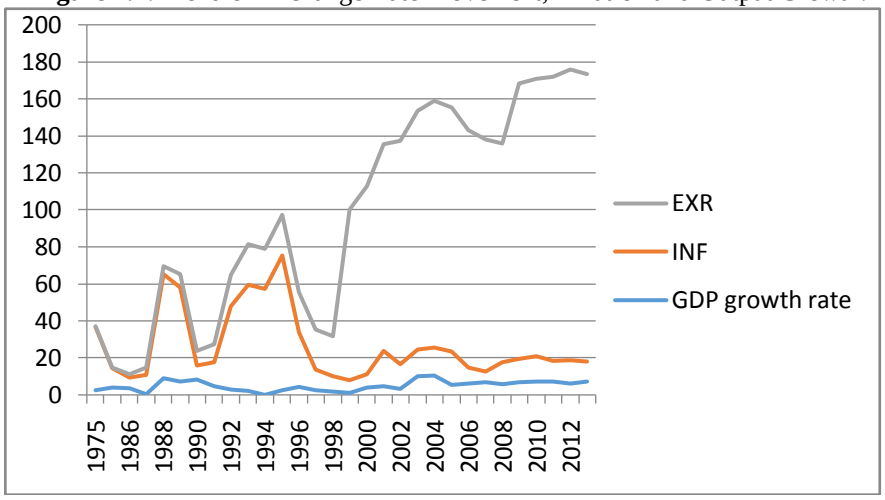
Exchange rate regime and changes in the interest rate remain important issues of discourse in international finance as well as in developing nations, with more economies embracing trade liberalization as a requisite for economic growth (Obansa, Okoroafor, Aluko and Eze, 2013). Nigeria, like many other low income open economies of the world, has adopted the two main exchange rate regimes for the purpose of gaining internal and external balance. The augments and conditions for and against each of the regime is clear given that they are all aimed at maintaining stability in exchange rates.

There is a high level consensus among many economists, central banks, policy makers and practitioners that one of the fundamental objectives of macroeconomic policies in both developed and developing economies is to sustain high economic growth together with low, one-digit inflation. This is because a high level of inflation disrupts the smooth functioning of a market economy (Krugman, 1995). Inflation imposes negative externalities on the economy when it interferes with an economy's efficiency, such as: uncertainty about the future profitability of investment projects (especially when high inflation is also associated with increased price variability), leading to more conservative investment strategies, lower levels of investment and economic growth. Inflation may also reduce a country's international competitiveness, by making its exports relatively more expensive, thus impacting on the balance of payments and exchange rate stability.

Figure 1.1 is a graphical illustration of movements in exchange rate, inflation, and output growth rate from 1975 – 2013 in Nigeria. Evidently, the persistent depreciation of the exchange rate trended with inflation and GDP growth rate. The exchange rate movements in the 1990s trended with inflation. A close observation of fig.1 indicates that during periods of high inflation rates, volatility in the exchange rate was high, which also reversed in a period of relative stability. For instance, while the inflation rate moved from 7.5 percent in 1990 to 57.2 percent and 72.8 percent in 1993 and 1995 respectively, the exchange rate moved from ₦8.04 to $1 in

1990 to ₦ 22.05 and ₦21.87 to a dollar in the same period. When the inflation rate dropped from 72.8 percent in 1995 to 29.3 percent and 10.7 percent in 1996 and 1997 respectively, and fell thereafter to 7.9 percent in 1998 and averaged at 12.05 percent in 2000 - 2011, the exchange rate trended in the same direction. Exchange rate, inflation and output growth flowed in the same direction. However, output growth rate was not impressive.

Figure 1.1: Trend of Exchange Rate Movement, Inflation and Output Growth.



***Source**: African Development Indicators.*

Exchange rate stability is considered to be a major policy objective in Nigeria aimed towards the achievement of a set of diverse objectives including economic growth, containment of inflation and maintenance of external competiveness. Policy discussions regularly emphasize on it as the academic literature provides compelling evidence to suggest that a wrongly managed exchange rate regime can be a major impediment for improved economic performance (Khondker, Bidisha, & Razzaque, 2012). Exchange rate instability, which refers to movement over time in the exchange rate of a country, can come in form of fluctuations: either an appreciation or a depreciation of the currency. Depreciation affects the output and inflation objectives of the central bank through three different channels. First, depreciation directly affects the rate of inflation. The impact of depreciation on inflation will depend on the level of the pass-through. Second, depreciation affects output through a balance sheet effect: the depreciation increases the cost of repayment of foreign currency denominated debt, reducing profits in this period, and thus the capital stock and output in the second period. Third, a larger depreciation entails a smaller increase in interest rates. Thus, a larger depreciation increases output in the second period, since the reduction in interest rate eases the credit constraint (the credit channel effect). The overall effect on income will depend on which of the two channels dominate. If the credit channel dominates over the balance sheet channel, depreciation is expansionary; otherwise, it is contractionary (Hossain and Ahmed, 2009). In judging the desirability of exchange rate fluctuations, it becomes, therefore, necessary to evaluate their effects on output growth, price and inflation. Demand and supply channels determine these effects (Kandil, 2004).Against this background, this study intends to investigate the impact of exchange rate stability on output level in Nigeria over a period of 33 years (1980 – 2013). The study is therefore organized as follows: Section one introduces has introduced the paper, section two contains the review of related literature, section three takes care of the research methods and procedures, section four contains the results from the data analysis and discusses the major findings, and section five summarizes the study, puts forward some fundamental recommendation and provides a conclusion for this study.

There is scarcely any country that lives in absolute autarky in this globalised world. All economies are linked directly or indirectly through the financial assets and/or commodity markets. This linkage is made possible through trade and foreign exchange. The price of foreign currencies in terms of a local currency (i.e. foreign exchange) is therefore important to the understanding of the growth trajectory of all countries of the world. The consequences of substantial misalignments of exchange rates can lead to output contraction and extensive economic hardship. Moreover, there is reasonably strong evidence that the alignment of exchange rates has a critical influence on the rate of growth of per capita output in low income countries (Isard, 2007). Stability in the exchange rate of the naira poses certain consequences for the economy. If the naira exchange rate is stable over time but the currencies of our trading partners are fluctuating (say depreciating), Nigeria's products in the international market will be less competitive (expensive), leading to large scale importation and decrease in the international reserves. However, if the naira exchange rate depreciates with that of our trading partners remaining stable, our product in the international market becomes highly competitive, leading to

increased exportation, reduced importation and increased international reserves. This however, may attract retaliatory effects from our trading partners. What then is the ideal exchange rate? The issue of an ideal exchange rate is necessary for the achievement of a set of diverse objectives - economic growth, containment of inflation and maintenance of external competiveness. Researchers in this area have been interested in diverse areas of study, studying mostly, the impact of exchange rate volatility on growth of which, the theoretical and empirical work on the studies had produced mixed results. This study therefore seeks to provide results with which Nigerian policy makers can make meaningful analysis on the attainment of an ideal exchange rate.

The general objective of this study is to examine the impact of exchange rate instability on industrial output in Nigeria and to determine the nature of relationship between output and trade openness in Nigeria. Therefore, this research hypothesizes are that there is no significant long run relationship between exchange rate instability and industrial output in Nigeria and that there is no significant relationship between output and trade openness in Nigeria

II. The Literature

This section documents some theoretical and empirical contributions on various aspects about the impact of exchange rate instability on industrial output. Much research has been devoted to explaining the macroeconomic effects of exchange rate regimes, exchange rate volatility, and researchers differ in methodologies and opinions, which makes the issue controversial. A major goal of macroeconomic policy is rapid economic growth in a country.

2.1 Review of Conceptual Literature

Economic growth is measured in terms of persistent growth in national income which translates to increases in the amount of goods and services produced in an economy. Growth is said to occur when a country's productive capacity is on the increase Akpan (2008). Production of goods and services involve exports and imports which in turn involves transactions in foreign exchange. Exchange rate in post Bretton Wood System has been characterized by instability and this has raised concern about its effect on economic growth. The impact of exchange rate volatility on growth, seen as a comprehensive measure of the benefits and costs of exchange rate stabilization can be x-rayed through international trade (imports/exports), foreign direct investment, credit flow, and asymmetric shock, some of the most important transmission channels from exchange rate volatility on growth Arratibel, Furceri, Martin and Zdzienicka (2009).

A depreciation (or devaluation) of the domestic currency may stimulate economic activity through the initial increase in the price of foreign goods relative to home goods. By increasing the international competitiveness of domestic industries, exchange rate depreciation diverts spending from foreign goods to domestic goods argued (Kandil, 2004). Thus, depreciation may allow domestic output level to rise promoting spending for home products.

Marshall Lerner condition holds that – 'devaluation will improve the trade balance if the devaluing nation's demand elasticity for imports plus the foreign demand elasticity for the nation's exports exceed 1 (one).' If the Marshall-Lerner condition is not satisfied, currency depreciation could produce contraction. Hirschman (1949) points out this fact and conclude that currency depreciation from an initial trade deficit reduces real national income and may lead to a fall in aggregate demand. Therefore, possible outcomes of currency depreciation are- firstly, in the goods market, an unexpected depreciation of the domestic currency will make imports more expensive than export, which will increase the demand for domestic products, increasing domestic output and price. Secondly, in the money market, an unexpected depreciation of the domestic currency, relative to its anticipated future value, prompts agents to hold more domestic currency and increases the interest rate, effects investment spending adversely and so does the aggregate demand leaving price level to rise. Thirdly, on the supply side, changes in the exchange rate, both anticipated and unanticipated, make imported intermediate goods costly; producers are inclined to decrease imports of intermediate goods, decreasing domestic output and increasing the cost of production and, hence, the aggregate price level (Kandil,2004). Accordingly, the effects of exchange rate fluctuation are highly debatable from its theoretical background.

2.2 The Trilemma and Mundell-Fleming's framework

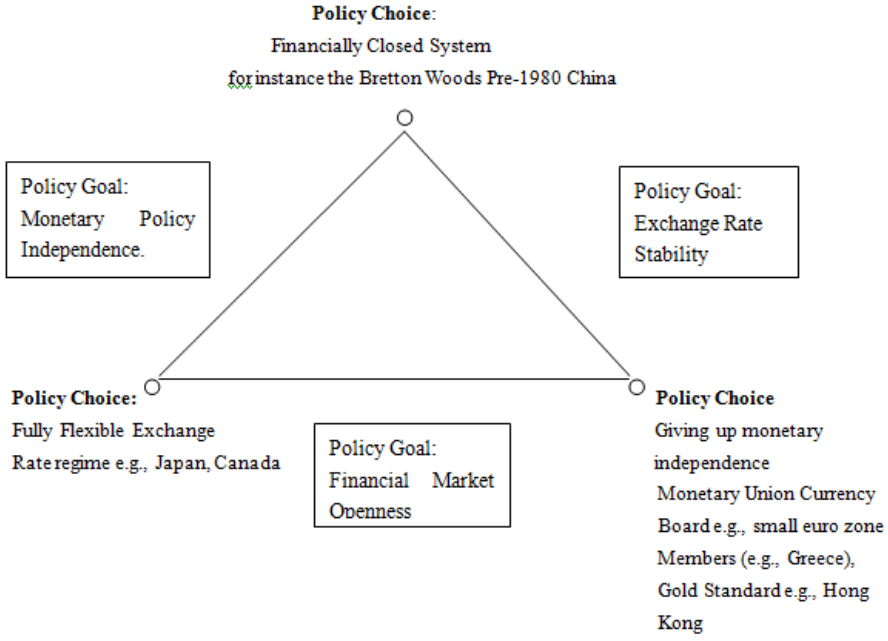
A fundamental contribution of the Mundell-Fleming framework is the impossible trinity, or the Trilemma. The Trilemma states that a country may simultaneously choose any two, but not all of the following three policy goals – monetary independence, exchange rate stability and financial integration. The "Trilemma triangle" is illustrated in Figure 2.1. Each of the three sides of the triangle, representing monetary independence, exchange rate stability, and financial market openness, depicts a potentially desirable policy goal. However it is not possible to be on all three sides of the triangle simultaneously. The top vertex, labeled "financially closed systems," is associated with monetary policy autonomy and a fixed exchange rate regime. But it represents financial autarky – the preferred choice of most developing countries in the mid to late 1980s. The left vertex,

labeled "fully flexible exchange rate", is associated with monetary independence, and financial integration – the preferred choice of the U.S. during the last three decades. The right vertex, labeled "giving up monetary independence", is associated with exchange rate stability (a pegged exchange rate regime), and financial integration, but no monetary independence – the preferred choice of the countries forming the Euro block (a currency union), and of Argentina during the 1990s (choosing a currency-board exchange rate regime). Among Mundell's seminal contributions in the 1960s was the derivation of the Trilemma in the context of an open economy extension of the IS-LM Neo-Keynesian model. The model considers a small country choosing its exchange rate regime and its financial integration with the global financial market.

To illustrate the resultant tradeoff, consider first a fixed exchange rate system with perfect capital mobility. This policy configuration corresponds to the policy pair associated with the right side of the trilemma triangle. In circumstances where domestic and foreign government bonds are prefect substitutes, credible fixed exchange rate implies that the domestic interest rate equals the foreign interest rate, as follows from the uncovered interest rate parity condition. If the central bank increases the supply of money, the incipient downward pressure on the domestic interest rate triggers the sale of domestic bonds, in search for a higher yield of foreign bonds. As a result of these arbitrage forces, the central bank is faced with an excess demand for foreign currency aimed at purchasing foreign bonds (and a matching excess supply of domestic currency). Under the fixed exchange rate, the central bank must intervene in the currency market in order to satisfy the public's demand for foreign currency at the official exchange rate. As a result, the central bank sells foreign currency to the public. In the process the central bank buys back the excess supply of domestic currency that is triggered by its own attempt to increase the supply of money. The net effect is that the central bank loses control of the money supply, which passively adjusts to the money demand. Thus, the policy configuration of prefect capital mobility and fixed exchange rate implies giving up monetary policy (Aizenman 2010). An open market operation only changes the composition of central bank's balance sheet between domestic and foreign assets, without affecting the monetary base and the domestic interest rate. This pair of policy choices implies that in a small open economy, determination of the domestic interest rate is relegated to the country to which it's exchange rate in pegged (corresponding to the right vertex of the Trilemma triangle). A small open economy wishing to maintain financial integration can regain its monetary autonomy by giving up the fixed exchange rate. Under a flexible exchange rate regime, expansion of the domestic money supply reduces the interest rate, resulting in capital outflows in search of the higher foreign yield. The incipient excess demand for foreign currency depreciates the exchange rate. Hence, in a flexible exchange rate regime with financial integration, monetary policy is potent. A higher supply of money reduces the interest rate, thereby increasing domestic investment, and weakens the domestic currency, which in turn expands the economy through increased net exports. This policy configuration corresponds to the policy pair associated with the left and the lower side of the trilemma triangle, attainable under a flexible exchange rate regime. However, achieving monetary independence requires the small open economy to give up exchange rate stability, implying a shift from the right vertex of the trilemma triangle to the left.

An alternative way for the small open economy to regain its monetary independence is to give up financial integration, and opt for exchange rate stability and monetary independence. Giving up financial integration prevents arbitrage between domestic and foreign bonds, thereby delinking the domestic interest rate from the foreign interest rate. Monetary policy operates in ways similar to the closed economy, where in the short run, the central bank controls the supply of money, and monetary expansion reduces the domestic interest rate. This policy configuration corresponds to the policy pair associated with the left and the right side of the trilemma triangle, attainable under closed financial markets and a pegged exchange rate, i.e., the top vertex. Monetary independence in this case gets traded off with financial integration. The sharp predictions of the Trilemma and its crisp intuitive interpretation made it the Holy Grail of the open economy neo-Keynesian paradigm. The impossible trinity has become self evident for most academic economists. Today, this insight is also shared by practitioners and policy makers alike.

Figure 2.1: The Trilemma (Impossible Trinity) Hypothesis.



Source: Aizenman 2010

2.3 Review of Empirical Literature

Previous research on the impact of exchange rate on economic growth has reached contrasting results. Although the short term and long term swings of exchange rates can strongly affect the growth performance of open economies through the trade channel, the empirical evidence in favour of a systematic positive or negative effect of exchange rate stability on trade (and thereby growth) has remained mixed (IMF 1984, European Commission 1990).

Gylfson and Schmidt (1983), in a bid to study how devaluation causes stagflation, constructed a log-linear macro model of an open economy for a sample of ten countries, using different estimates of the key parameters of the model. Their results showed that devaluation was expansionary in eight out of ten countries investigated. Devaluation was found to be contractionary in two countries (the United Kingdom and Brazil). Morley (1992) analyzed the effect of real exchange rates on output for twenty eight developing countries that had devalued their currencies using a regression framework. After the introduction of controls for factors that could simultaneously induce devaluation and reduce output including terms of trade, import growth, the money supply and the fiscal balance, the findings show that depreciation of the level of the real exchange rate reduced the output level.

Rodriguez and Diaz (1995) estimated a six variable VAR model (having variables for output growth, real wage growth, exchange rate depreciation, inflation, monetary growth, and the Solow residuals) in an attempt to decompose the movement of Peruvian output. The study finds that output growth was mainly explained by its "own" shocks but was negatively affected by increase in exchange rate depreciation. Rogers and Wang (1995), researching on the Mexican economy, obtained similar results using a five variable VAR model (containing variables for output, government spending, inflation, the real exchange rate, and the money growth). The study notes that most variations in the Mexican output resulted from "own shocks" and also noted that exchange rate depreciation led to a decline in output. Copelman and Wermer (1996) adopting the same methodology above, though with slightly different variables, reported that positive shocks to the rate of exchange rate depreciation, significantly reduced credit availability, with a negative impact on the output. Surprisingly, they found that shocks to the level of the real exchange rate had no effects on the output, indicating that the contradictory effects of devaluation are more associated with the level of change of the real exchange rate. They equally found that "own" shocks to real credit did not affect the output, implying that depreciation depressed the output through mechanisms other than the reduction of credit availability.

Kamin and Klau (1998), using an error correction technique, estimated a regression equation linking the output to the real exchange rate for a group of twenty seven countries. The study did not find that devaluations were contradictory in the long term. Additionally, through the control of the sources of spurious correlation, reverse causality appeared to alternate the measured contractionary effect of devaluation in the short term although, the effect persisted even after the introduction of controls.

Barkoulas, Baum and Caglayan (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. Servén (2003) also showed that real exchange rate volatility negatively affects investment in a large panel of developing countries. This negative impact is significantly larger in countries with highly open economies and less developed financial systems. This study also found evidence of threshold effects, whereby uncertainty only matters when it is relatively high.

Ogun (2006) studied on the impacts of real exchange rate on growth of non-oil export in Nigeria and highlighted the effects of real exchange rate misalignment and volatility on the growth of non-oil exports. The study employed the standard trade theory model of determinants of export growth and two different measures of real exchange misalignment, one of which entails deviation of the purchasing power parity (PPP), and the other which is model based estimation of equilibrium real exchange rate (RER). It observed that irrespective of the alternative measures of misalignment, both real exchange misalignment and volatility adversely affected growth of Nigerian non-oil exports. Mirelle (2007) argues that overvaluation of exchange rates have constituted a major setback in the recovery process of Nigeria and Benin Republic. In addition, the study suggests that devaluation accompanied with well targeted measures alongside an upward adjustment in the domestic prices of tradable goods, could restore exchange rate equilibrium and improve economic performance.

Rodrik (2009) argued that real undervaluation promotes economic growth, increases the profitability of the tradable sector, and leads to an expansion of the share of tradable in domestic value added. He claims that the tradable sector in developing countries can be too small because it suffers more than the non-tradable sector from institutional weaknesses and market failures. A real exchange rate undervaluation works as a second-best policy to compensate for the negative effects of these distortions by enhancing the sector's profitability. Higher profitability promotes investment in the tradable sector, which then expands, and promotes economic growth.

Adebiyi and Dauda (2009), using error correction model, argued on the contrary that trade liberalization promoted growth in the Nigerian industrial sector and stabilized the exchange rate market between 1970 and 2006. This study maintains that there was a positive and significant relationship between index of industrial production and real export. A one per cent rise in real export increases the index of industrial production by 12.2 per cent. By implication, it means that the policy of deregulation impacted positively on export through exchange rate depreciation. Aghion, Bacchetta, Ranciere, and Rogoff (2009) examined the effect of exchange rate fluctuations on Nigerian manufacturing industry. The study employed multiple regression econometric tools which shows that the negative effect of real exchange rate volatility on economic growth shrinks in countries with higher levels of financial development.

Akpan and Atan (2011) investigated the effect of exchange rate movements on real output growth in Nigeria for the period 1986 to 2010. Using quarterly series, they employed the simultaneous equations model within a fully specified (but small) macroeconomic model and a generalized method of moments technique. This study found no evidence of a strong direct relationship between changes in exchange rate and output growth; rather, Nigeria's economic growth had been directly affected by monetary variables. The study further concluded that improvements in exchange rate are necessary but not adequate to revive the Nigerian economy. Furthermore, Eme and Johnson (2012) investigated the effect of exchange rate movements on real output growth in Nigeria for the period 1986 – 2010. The result revealed that there is no evidence of a strong direct relationship between changes in exchange rate and output growth. Rather, Nigeria economic growth has been directly affected by monetary variables.

From the foregoing, it is obvious that a lot of studies have been conducted in this area of research but there is no consensus in literature because the theoretical and empirical works on these studies have produced mixed results. This study therefore seeks to provide results with which Nigerian policy makers can make meaningful analysis on the attainment of an ideal exchange rate.

III. Research Methods

3.1 Theoretical Framework

This study adopts, as its theoretical framework, the Solow growth model which is an exogenous growth model of long run economic growth set within the framework of neoclassical economics. The model attempts to explain long run economic growth by looking at capital accumulation, labour or population growth, and increase in productivity, commonly referred to as technological progress. Therein, output is produced using two factors of production, labour (L) and capital (K), in an aggregate production function that satisfies the **Inada** conditions (which assumes the stability of an economic growth path in a neoclassical growth model) and which imply that the elasticity of substitution must be asymptotically equal to one. This is presented in Equation 1 as

$$Y_{(t)} = K_{(t)}^{\alpha} [A(t) L(t)]^{1-\alpha} \quad (1)$$

where: t is time; $0<\alpha<1$ is the elasticity of output; $Y_{(t)}$ represents total production; A refers to labour augmenting technology or knowledge; AL represents effective labour.

All factors of production are fully employed and initial values A (0), K (0), and L (0) are given.

More generally, Equation 1 is presented as

$Y = f(K, L)$ (2)

The Solow growth model can be expanded to contain variables to capture the macroeconomic environment like inflation, exchange rate, and external sector activities like external trade balance (balance of trade), foreign direct investment (FDI), in line with the nature of the present study.

3.2 Empirical Model Specification

For thw purpose of determining the extent to which changes in the exchange rate impacts on industrial output in Nigeria, Equation 2 can be expanded to Equation 3 to form the empirical model. Thus, the empirical model is presented as

$IND = f(K, L, INF, EXR, BOT, FDI)$ (3)

where IND is industry value added (% of annual growth) is a measure of the industrial output level, K is gross capital formation proxied by domestic investment, L is effective labour proxied by the population growth rate, INF is inflation rate which measures domestic macroeconomic stability (cost of living), EXR is exchange rate which measures the cost of acquiring other country's currency, BOT is balance of trade which measure a country's external trade balance (trade openness) and FDI is the foreign direct investment which measures capital inflow as a result of trade openness.

Equation 3 is further expressed in its log form in equation 4 to make it possible to interpret the estimated coefficients as elasticities. Hence:

$LnIND = \beta_0 + \beta_1 LnCAP + \beta_2 LnPOP + \beta_3 LnEXR + \beta_4 LnINF + \beta_5 LnBOT + \beta_6 LnFDI + \mu$ (4)

where μ is the stochastic error term; β_0 is the intercept; $\beta_1 - \beta_6$ are the coefficients of the independent variables. All variables are in their natural logarithm form and the data used for this paper are basically annual data covering 1980 to 2013 (thirty three (33) years). The data were sourced from the African Development Indicators, Central Bank of Nigeria (CBN) Statistical Bulletin and World Development Indicators.

3.3 Estimation Techniques and Procedures

The estimation techniques and procedures is designed as follows:

- Unit Root Test: Macroeconomic time series data are generally characterized by stochastic trend which can be removed by differencing. Thus, this paper adopted the Augmented Dickey-Fuller (ADF) Techniques to test and verify the unit root property of the series and stationarity of the model.
- Co integration Test: This was used to test for the existence of long run relationship among the variables.
- Newey-West Hac standard errors and covariance test was used to correct the effect of heteroscedasticity and auto correlation.

IV. Data Analyses, Results Presentation and Discussion of Findings

4.1 Data Analyses

In order to establish an empirical relationship between industrial output and its determinants, the estimates systematically with respect to the regression model specified in section three is presented herein. The regression result captures the objectives of the research and the estimations were carried out using the Economic Views (E-views 6.0) statistical software.

The data analysis begins with the application of the augmented dickey-fuller technique in testing the unit root property of the series and the application of the co integration test for the existence of long run relationship amongst the variables. Recent studies suggest that most macroeconomic time series are non-stationary in their levels, that is, they have unit roots. These series can be made stationary through differencing and/or detrading (Enders, 2009; Maddala, 1999). Using ADF (augmented dickey-fuller) test, the time series considered in this study have been tested for unit roots to check their stationarity. Finally, the ordinary least square (OLS) method is employed to arrive at the regression equation for the desired coefficients.

Table 4.1 presents the results of the unit root test using the augmented dickey fuller procedures and it shows that all the variables are stationary at first difference at 5% level of significance in order of integration I(1)..

Table 4.1: Summary of Stationarity Tests

Variable	ADF statistic	Level of significance	Lagged difference	Critical values	Order of integration	Conclusion
LNIND	-4.553454	5%	1	-2.954021	I (1)	Stationary
LNBOT	-7.672551	5%	1	-2.960411	I (1)	Stationary
LNCAP	-4.441828	5%	1	-2.957110	I (1)	Stationary
LNFDI	-11.03439	5%	1	-2.957110	I (1)	Stationary
LNINF	-3.461865	5%	1	-2.954021	I (1)	Stationary
LNPOP	-6.932749	5%	1	-2.960411	I (1)	Stationary
LNRER	-4.546575	5%	1	-2.957110	I (1)	Stationary

Source: Researchers' Computations

4.2 Results Presentation and Discussion of Findings

1. Cointegration Test

Table 4.2: Summary of Johansen Co integration Test

Variable	Eigenvalue	Trace statistic	5percent critical value	Hypothesis no of CE (s)
LNBOT	0.981228	288.2034	125.6154	None *
LNCAP	0.848739	95.75366	160.9917	At most 1
LNFDI	0.743323	69.81889	100.5518	At most 2
LNIND	0.552107	47.85613	57.03375	At most 3
LNINF	0.380948	29.79707	31.33129	At most 4
LNPOP	0.265823	15.49471	15.98516	At most 5
LNRER	0.173480	3.841466	6.097004	At most 6

Trace test indicates 1 co integrating equation(s) at the 0.05 level
* denotes rejection of the hypothesis at the 0.05 level

***Source**: Researchers' Computation*

Results on Table 4.1 show that all the variables are stationary at order one. The results of the Johansen Co integration test is presented on Table 4.2 and it can be inferred that a long-run relationship (or co-integration) exists amongst the variables of the model (industrial value added, population growth rate, inflation rate, exchange rate, domestic investment, balance of trade and foreign direct investment) (see also Appendix 1). The trace statistic indicates that this model has one cointegrating vector at 0.05 level of significance as shown in Table 4.2. This study therefore rejects the hypothesis of no cointegration at 5% significance level.

2. Long Run Results and Evaluation of Estimates

Except for foreign direct investment, gross capital formation and inflation variables, all other variables in the model conform to the economic a priori expectation as shown in Table 4.3 which contains the long run results.

Table 4.3: Summary of Regression Results

Variables	**Coefficient**	**std error**	**t-Statistic**	**Probability**
C	1.214636	0.772994	1.571340	0.1278
LNBOT	0.007666	0.010197	0.751745	0.4587
LNCAP	-0.171098	0.072125	-2.372241	0.0251
LNFDI	-0.540539	0.130489	-4.142415	0.0003
LNINF	0.167971	0.227202	0.739304	0.4661
LNPOP	2.251443	0.391926	5.744558	0.0000
LNRER	0.217920	0.054059	4.031152	0.0004

Model Fit	**Coefficient**	**Probability**
R^2	0.969276	
Adjusted R^2	0.962448	
F-Statistic	141.9638	0.0000000
Diagnostic Test		
Durbin- Watson statistic	2.709830	

The long run regression estimates for the model thus presented as:

LnIND = 1.214636 + 0.007666LnBOT - 0.171098LnCAP - 0.540539LnFDI + 0.167971LnINF +

2.251443LnPOP + 0.0217920LnRER (5)

The statistical significance of the estimated parameters in this model is ascertained by the R^2, adjusted R^2, t-statistic and F-statistic tests. The regression result shows that the coefficient of determination $R^2$is 0.969276, while the adjusted R^2 is 0.962448. Thus, our estimated model achieved a strong goodness of fit. Accordingly, we conclude that the mix of regressors in this model on the average account for about 96.93% of the changes in the industry output level in Nigeria, while the remaining 3.07% variation is accounted for by the error term. The adjusted R^2 supports the claim of the R^2 with a value of 0.962448 indicating that 96.24% of the total variation in the dependent variable (industry output) is jointly explained by the independent variables. Thus, this supports the statement that the explanatory power of the variables is high.
From the regression estimates it can be further observed that the calculated F-statistic is 141.9638. Moreover, the critical F-value is computed thus; Degree of freedom = k – 1, and n – k, where n and k are the number of observations and variables respectively.

$F_{tab}= F_{0.05}$ (7– 1, 34 –7) = $F_{0.05}$ (6, 27) = 2.45

The decision is that since F_{cal}(141.96) >F_{tab}(2.45), we reject H_0 and accept H_1. This simply implies that at least one of the variables in the model is statistically significant. The probability of the calculated F being 0.0000 and of course less than the level of significance, as well further affirms the overall significance of the model.

The t-test is used in determining the statistical reliability and significance of the individual parameters used in the model. From the regression results in table 4.2.3 above, not all variables were statistically significant. Domestic investment (CAP), foreign direct investment (FDI), population growth rate (POP) and real exchange rate (RER) had their absolute t-values greater than 1.96 thus they are statistically significant, while balance of trade (BOT) and inflation rate (INF) whose absolute t-values are less than 1.96 were considered non-significant. Thus, CAP, FDI, POP, and RER are significant determinants of industry output level in Nigeria.

To determine the reliability of the statistical criteria, and establish whether or not the estimates have desirable properties of no bias, consistency, and no auto correlation, the Durbin Watson (DW) statistic was used. From the results, DW statistic was 2.709830 implying some degree of negative auto correlation. Thus, the Newey-West HAC Standard Errors and Covariance that was employed in the regression (see Appendix I) which produces (lag truncation = 3) was necessary to correct the effect of heteroscedasticity and autocorrelation in the model.

In evaluating of the research hypotheses, the hypotheses which satisfy the already stated objectives were tested at 5% level of significance and a critical t-value of 1.96. The decision rule was to accept H_0 if $t_{cal} < 1.96$ or if $P > 0.05$, otherwise reject H_0. Of all the six variables, only FDI and CAP were statistically significant, implying that they impact heavily on the industry output level in Nigeria.

The constant (1.214636) denotes the value of industry output when other variables are zero. Hence, when FDI, CAP, INF, POP, and EXR are zero, industry output level is constant at 121.46 per cent. The results further imply that a 1 per cent increase in external balance implies a 0.8 per cent increase in output. The statistically non significant nature of the balance of trade coefficient, which is indicated by its high probability, could be as a result of the inability of Nigeria's exports to fit into the international market competition.

The negative values of gross capital formation and foreign direct investment which negates the economic a priori expectation, implies that a 1 per cent increase decreases the output level by 17.1 and 54.1 per cent respectively. This suggests that Nigeria is yet to properly harness sufficient low cost capital for industrial production.

The positive sign of inflation rate implies a high inflation rate of 16.8 per cent which is above the ideal single digit rate. It implies that a 1 per cent increase in the inflation rate, drastically increases the cost of industry output by 16.8 per cent, although the t-test and probability results show that it is statistically non significant.

A 1 percent increase in the population rate implies a 225 per cent increase in industrial output. This means that as more labour is involved in productive activity, Nigeria's output level rises. The positive sign of the real exchange rate conforms to the economic a priori expectations. It implies that a 1 per cent increase in exchange rate (depreciation) implies a 2.2 per cent increase in industry output since depreciation of the exchange rate promotes exports in Nigeria.

V. Summary of Findings, Recommendations and Conclusion

5.1 Summary of Findings

The study was basically undertaken to examine the impact of exchange rate stability on industry output level in Nigeria. In executing the study, augmented dickey fuller (ADF) unit root test was used, the ordinary least square (OLS) was applied after determining the co integration of variables using the Johansen approach, and cushioning the effect of autocorrelation and heteroscedasticity on standard errors using the Newey-west method.

From the results of the ordinary least square which was applied on six variables- considered as the relevant determinants of industry output in Nigeria (domestic capital, foreign direct investment, population growth rate, and real exchange rate) were significant determinants of industry output level. The changes in external balance and inflation were of little or no consequences to industry output considered individually using t-test. Following this, the study agrees that there exist long-run relationship between domestic capital, foreign direct investment, population growth rate, real exchange rate, external balance, inflation and industry output in Nigeria.

5.2 Recommendations

Based on the findings of this research, it was necessary to provide a set of policy recommendation that would be applicable to the Nigeria economy. The researcher suggests the following policy options:

- ✓ Export promotion strategy should be reviewed and strengthened so as to positively impact industry output level.
- ✓ Import substitution strategy should also be reviewed so as prevent retaliatory attacks from our trading partners.
- ✓ An appropriate environment and infrastructural facilities should be provided by the government so that foreign investors will be attracted to invest in Nigeria. This would help to advance our industrial output.
- ✓ The foreign exchange control policies adopted should take international market fluctuations into consideration when determining an ideal exchange rate value. This will go a long way to strengthen the naira.
- ✓ Government should be very critical while devaluing the nation's currency to avoid retaliatory effects, and also maintain stability in the exchange rate.
- ✓ The regulatory and supervisory framework for the financial sector should be strengthened so as to ensure that appropriate monitoring is made to ensure that the money mapped out for the investment project is reached to their targeted goal.
- ✓ Manufacturing industries should improve on the quality of their output would to increase its competitiveness in the global market

5.3 Conclusion

This study examined the impact of exchange rate stability on industry output and threw some light on the fact that the industrial output and its explanatory variable are interrelated and that decisions in one variable affects the other variables. Doubtless, some deterministic variables have desirable effect while others contribute undesirable effect to industry output in Nigeria. It was therefore concluded that, foreign exchange control policies adopted by government and monetary authorities should take international market fluctuations into consideration when determining an ideal exchange rate value. This will go a long way to strengthen the naira and prevent retaliatory effects. Also, conscious efforts should be made by government to fine-tune the various macroeconomic variables in order to provide an enabling environment that stimulates industry output.

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APPENDIX I Cointegration Result

Date: 10/14/14 Time: 18:31
Sample (adjusted): 1982 2013
Included observations: 32 after adjustments
Trend assumption: Linear deterministic trend
Series: LNBOT LNCAP LNFDI LNIND LNINF LNPOP LNRER
Lags interval (in first differences): 1 to 1

Unrestricted Cointegration Rank Test (Trace)

Hypothesized No. of CE(s)	Eigenvalue	Trace Statistic	0.05 Critical Value	Prob.**
None *	0.981228	288.2034	125.6154	0.0000
At most 1	0.848739	95.75366	160.9917	0.0000
At most 2	0.743323	69.81889	100.5518	0.0000
At most 3	0.552107	47.85613	57.03375	0.0054
At most 4	0.380948	29.79707	31.33129	0.0330
At most 5	0.265823	15.49471	15.98516	0.0422
At most 6	0.173480	3.841466	6.097004	0.0135

Trace test indicates 1 cointegrating eqn(s) at the 0.05 level
* denotes rejection of the hypothesis at the 0.05 level
**MacKinnon-Haug-Michelis (1999) p-values

Unrestricted Cointegration Rank Test (Maximum Eigenvalue)

Hypothesized No. of CE(s)	Eigenvalue	Max-Eigen Statistic	0.05 Critical Value	Prob.**
None *	0.981228	127.2117	46.23142	0.0000
At most 1 *	0.848739	60.43998	40.07757	0.0001
At most 2 *	0.743323	43.51801	33.87687	0.0026
At most 3	0.552107	25.70246	27.58434	0.0854
At most 4	0.380948	15.34613	21.13162	0.2654
At most 5	0.265823	9.888153	14.26460	0.2194
At most 6	0.173480	6.097004	3.841466	0.0135

Max-eigenvalue test indicates 3 cointegrating eqn(s) at the 0.05 level
* denotes rejection of the hypothesis at the 0.05 level
**MacKinnon-Haug-Michelis (1999) p-values

APPENDIX 2 Regression Result

Dependent Variable: LNIND
Method: Least Squares
Date: 10/14/14 Time: 18:21
Sample: 1980 2013
Included observations: 34
Newey-West HAC Standard Errors & Covariance (lag truncation=3)

Variable	Coefficient	Std. Error	t-Statistic	Prob.
C	1.214636	0.772994	1.571340	0.1278
LNBOT	0.007666	0.010197	0.751745	0.4587
LNCAP	-0.171098	0.072125	-2.372241	0.0251
LNFDI	-0.540539	0.130489	-4.142415	0.0003
LNINF	0.167971	0.227202	0.739304	0.4661
LNPOP	2.251443	0.391926	5.744558	0.0000
LNRER	0.217920	0.054059	4.031152	0.0004

R-squared	0.969276	Mean dependent var	1.287469
Adjusted R-squared	0.962448	S.D. dependent var	3.933840
S.E. of regression	0.762312	Akaike info criterion	2.476320
Sum squared resid	15.69024	Schwarz criterion	2.790571
Log likelihood	-35.09744	Hannan-Quinn criter.	2.583489
F-statistic	141.9638	Durbin-Watson stat	2.709830
Prob(F-statistic)	0.000000		