Determinants of Exchange Rate Sensitivity on the Nigerian Manufacturing Sector

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Abstract

This paper examines the exchange rate sensitivity and its determinants with special focus on the Nigerian Manufacturing Sector (1980-2014). The motivation for this study is driven by the exposure of Nigeria's exchange rate and economy excessively to external shocks as revealed by the effects of the recent global economic crisis on Nigeria. In doing this, Error Correction Model (ECM), Augmented Dickey-Fuller (ADF) testand the Johansen co-integration technique were adopted to examine the impact of exchange rate fluctuations on Nigeria's manufacturing sector. The variables employed include: Average Official Exchange Rate of Naira vis-à-vis US Dollar and Nominal Effective Exchange Rate Indices, interest rate, inflation rate, Balance of Payment (BOP), real Gross Domestic Product (GDP), manufacturing index of ordinary shares listed on the Nigerian Stock Exchange, and average manufacturing capacity utilisation rates. The result of the empirical analyses showed that the Nigerian manufacturing sector is not sensitive to exchange rate fluctuations in the long-run. Also, it was found that interest rate and Gross Domestic Product are the main determinants of exchange rates in Nigeria but interest rateis insignificant in the determination of exchange rate in the country. Some of the recommendations made in this study are that: the monetary authorities should maintain stability of the exchange rates through proper management so as to encourage local production, the monetary authorities must endeavour to force the interest rate down and continue to advocate for priority lending to the manufacturing firms. Equally, the government must continue to discourage importation in order to maintain exchange rate stability.

Keywords: Exchange rate, Sensitivity, Manufacturing sector, *Determinants,* Error correction model, Nigeria.

Contents

1. Introduction

An important dilemma in international finance is the exchange rate puzzle. This issue is important because exchange rate fluctuations are likely, in turn, to determine economic performance vis-à-vis firms' performance among others. It is a dilemma because of its randomness, which Lipsey and Chrystal (1995) attribute to its responsiveness to News. The volatility and unpredictability of exchange rate is due to the confluence of the factors that affect it (Anoruo *et al.*, 2006; Benita and Lauterbach, 2007; Hanias and Curtis, 2008). As such, the issue of exchange rate sensitivity and determinacy is controversial and has been a subject of much debate. A large number of studies and articles addressed the issue both theoretically and empirically and found different results, which have fueled the debate further controversial. The traditional view is that fluctuations in exchange rates affect relative domestic and foreign prices, causing expenditures to shift between domestic and foreign goods (Betts and Kehoe, 2005; Benita and Lauterbach, 2007; Khan *et al.*, 2010). The new view is that relative prices are not much affected by exchange rate fluctuations in the short-run (Cheong, 2004).

In general, when a currency depreciates it will result in higher import prices if the country is an international price taker, while lower import prices result from appreciation. The potentially higher cost of imported inputs associated with exchange rate depreciation increases marginal costs and leads to higher price of domestically produced goods (Kandil, 2004). Further, import-competing firms might increase prices in response to foreign competitor price increases to improve profit margins. The extent of such price adjustment depends on a variety of factors such as market structure, the relative number of domestic and foreign firms in the market, the nature of government exchange rate policy and product substitutability (Sekkat and Mansour, 2000; Fouquin *et al.*, 2001).

Most Nigerian manufacturing companies depend on imported inputs in the form of equipment, plant and machinery and other materials and given the fact that bulk of the country's foreign earnings is from oil earnings which accounts for over 87.6 per cent of the foreign exchange earnings in 2010 (Central Bank of Nigeria, 2010) thus revealing the extent of the vulnerability of these companies to swings in the exchange rate which is greatly affected by fluctuations in the oil price in the international market. Mohammad (2010) notes that the risks associated with volatile exchange rates are major impediments for countries such as Nigeria that attempt to develop through export expansion strategy and financial liberalization. Besides, Chong and Tan (2008) hint that the impact of exchange rate volatility on economic fundamentals is substantially great if an economy does not provide possible tools in hedging currency risk in its market place which unfortunately, is the case in Nigeria. Furthermore, Chong and Tan (2008) argue that exchange rate volatility has a catalytic effect to various parties as well as countries.

One of the most dramatic events in Nigeria over the past two decades was the devaluation of the Nigerian Naira with the adoption of a Structural Adjustment Programme (SAP) in 1986. A cardinal objective of the SAP was the restructuring of the production base of the economy with a positive bias for the production of agricultural exports. The foreign exchange reforms that facilitated a cumulative depreciation of the effective exchange rate were expected to increase the domestic prices of agricultural exports and therefore boost domestic production. Significantly, this depreciation resulted in changes in the structure and volume of Nigeria's exports and imports. However, the volatility, frequency and instability of the exchange rate movements since the beginning of the floating exchange rate raise a concern about the impact of such movements on Nigerian manufacturing companies.

Nigerian manufacturing sector has remained underdeveloped and is not showing significant growth despite the implementation of Structural Adjustment Programme (SAP). According to Delude (1999) apart from objectives not realized, exchange rate policy and management under Structural Adjustment Programme (SAP) have left some issues unresolved and/or created some distortions in the economy, one of which is deindustrialization. A close look at the relative contribution of manufacturing production to Gross Domestic Product (GDP) before and after SAP shows that SAP, indeed, triggered a shrinking of the manufacturing sector in Nigeria. In 1980, manufacturing accounted for 8.4% of Gross Domestic Product (GDP). This relative share rose to 9.9% in 1983, and was still 8.7% in 1986 (Central Bank of Nigeria, 2010b). But, with the adoption of SAP, the manufacturing sector's relative share in GDP began to fall and reached a low of 5.29% in 1989 and fell further to 5% of the GDP in 1997 (CBN, 2010b). However, since enthronement of democracy in 1999, the contribution of the sector to GDP increased slightly to 9.6% in 2007 but fell to 7.6% in 2010 (CBN, 2010a). Apart from structural rigidity, poor quality of labour force, high interest rate, corruption etc (Delude, 1999) that is responsible for the poor performance of the sector, exchange rate volatility is also a major factor that affects its performance.

1.1. Statement of the Problem

The year 2009 was overcast by the global financial and economic crisis, which was precipitated in August 2007 by the collapse of the sub-prime lending market in the United States. The crisis led to the crash of most other sectors and markets across Europe with consequent effect on developing economies especially oil-export dependent countries like Nigeria. The impact was aggravated by the reduction in crude oil production due to the persistent restiveness in the Niger Delta region.

The spiral effect of the global economic crisis on Nigerian economy continued in 2009 with the exorbitant lending rate mounting pressure on the stock market as a result of massive borrowed fund in the market. The rush by stock investors to liquidate their investment to repay their loans in order to avoid the excessive lending rate caused the Nigerian stock market to crash. This decline was also driven by concerns over unrealistically high valuations in practically all sectors. Regulatory intervention in the equities market only served to dent investor confidence further, especially among institutional investors, as the measures failed to address the fundamental issues.

The effect of the global economic meltdown on Nigerian exchange rate was phenomenon as the Naira exchange rate vis-à-vis the dollar rose astronomically from about N120/$ to more than N180/$ (about 50% increase) between 2008 and 2009. This is attributable to the sharp drop in foreign earnings of Nigeria as a result of the persistent fall of crude oil price, which plunged from an all time high of US$147 per barrel in July 2007 to a low of US$45 per barrel

in December 2008. It is evident from the foregoing that the recent global economic crisis has further revealed that Nigerian economy is excessively exposed to external shocks. Although various factors have been adduced to Nigeria's poor economic performance, the major problem has been the economy's continued excessive reliance on the fortunes of the ever unstable oil market for foreign exchange thereby causing frequent volatility in the country's exchange rate.

The renewed emphasis on the production of alternatives to fossil-fuel energy, such as solar, wind and bio energy in the advanced economies would reduce oil demand and further weaken Nigeria's foreign earnings. Thus, in the absence of concerted efforts to shore-up and widen the revenue base, there will be reduction in crude oil revenue, excess crude oil receipts savings and foreign exchange earnings in the coming years. This will spell doom for the manufacturing companies in the country who rely on foreign exchange for the purchase of most of their inputs. The fact that crude oil is an exhaustible asset makes it unreliable for sustainable development of the Nigerian economy (Utomi, 2004).

The continued unimpressive performance of the Nigerian manufacturing sector and the vulnerability of the external sector thus dictate the urgent need for a reappraisal of the thrust and contents of the development policies and commitments to their implementation. Indeed, the need for a change in the policy focus and a shift in the industrialization strategy is imperative, if Nigerian economy is to be returned to the path of sustainable growth and external viability. This raises the question of the sensitivity of Nigerian manufacturing companies to exchange rate fluctuation, which is the essence of this study.

1.2. Objectives of the Study

The broad objective of this study is to analyse Nigeria's exchange rate. The specific objectives of the study are as follows:

1. To examine exchange rate volatility in Nigeria;
2. To investigate the impact of exchange rate fluctuation on Nigerian manufacturing sector;
3. To evaluate the effect of macroeconomic factors on the Nigerian exchange rate.

1.3. Research Questions

The research questions that would be examined in the course of the study are as follows:

1. How volatile has the exchange rate of Nigeria been over the years?
2. To what extent is the Nigerian manufacturing sector sensitive to exchange rate fluctuations?
3. What are the macroeconomic factors that are responsible for the exchange rate fluctuations in Nigeria?

1.4. Research Hypotheses

Hypothesis 1:
H_0: That Nigeria's exchange rate fluctuation does not significantly affect her manufacturing sector.
H_1: That Nigeria's exchange rate fluctuations significantly affect her manufacturing sector.
Hypothesis 2:
H_0: Nigerian manufacturing sector is not sensitive to exchange rate fluctuations.
H_1: Nigerian manufacturing sector is sensitive to exchange rate fluctuations.
Hypothesis 3:
H_0: That Nigeria's exchange rate is not significantly determined by her macroeconomic factors.
H_1: That Nigeria's exchange rate is significantly determined by her macroeconomic factors.

2. Theoretical Framework for Exchange Rate Determination

Exchange rates are prices of one currency in terms of another. In a more formal sense, exchange rate indicates the international value of money in terms of purchasing power, and changes in exchange rate indicates changes in this value. In a free foreign exchange market, exchange rates are determined by supply and demand, like other free market prices, exchange rates could be determined under three conditions:

a. Under freely floating rates.
b. Under conditions when governments intervene at certain points, to prevent wider fluctuations in exchange rates.
c. Under a gold standard.

It is expected that within the relevant range, demand curves for foreign exchange are downward slopping, so that in the absence of intervention the exchange rate tends to move towards equilibrium at the intersection of the demand and supply curves.
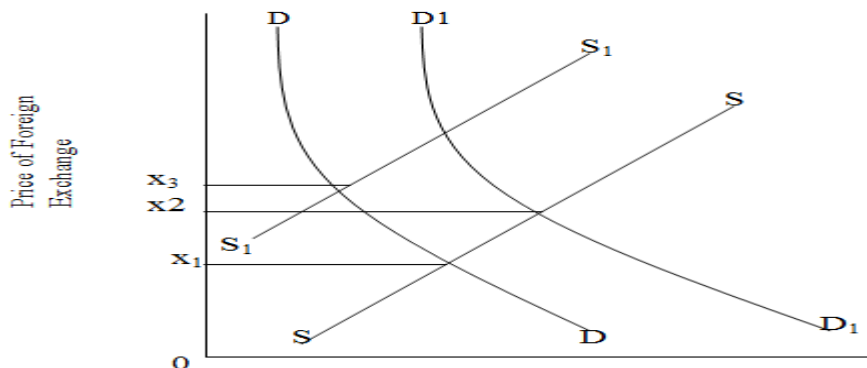

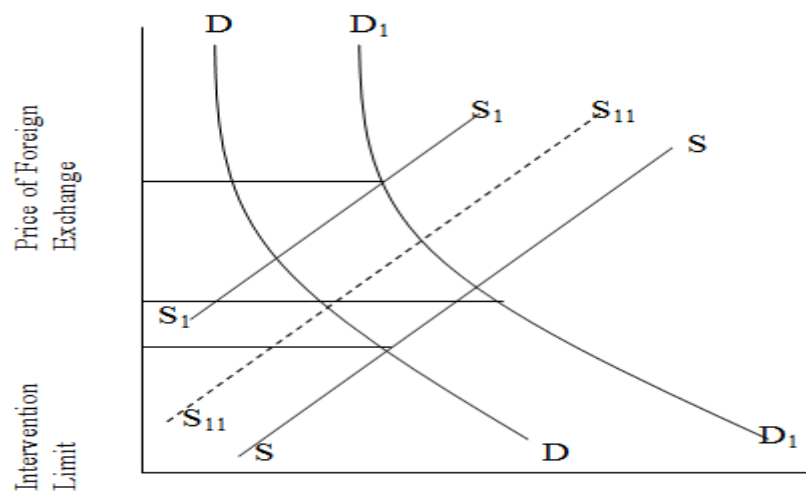**Figure-2.1.** Quantity of Foreign Exchange

Source: Author's Computation

Figure-2.2. Quantity of Foreign Exchange

Figure 2.1 and 2.2 show the market determination of exchange rates under freely floating rates and conditions of government intervention, respectively. If D is the demand curve and S is the supply curve.

In Figure 2.1 the equilibrium exchange rate is at x_1. If the demand curve shifts to D_1 the equilibrium exchange rate would rise farther to x_2 and if the supply curve should then shift to S_1 the equilibrium exchange rate would rise farther to x_3.

In Figure 2.2 illustrates the situation when there is government intervention. If D and S are the demand and supply curves, there is no need for government action because the equilibrium rate is close to but not below the lower intervention point. If the demand curve shifts to D_1, the exchange rate rises but there is no need for government action. If however, the supply curve then shifts from S to S_1, government action occurs otherwise the equilibrium rate would rise above the upper intervention level. Government can supply foreign exchange such that the supply curve shifts to S_{II} so that the equilibrium rate is at but not above the upper intervention level. The purpose of government intervention is to prevent temporary factors for causing shifts in demand and supply curves which in turn cause fluctuations in exchange rates which may be detrimental to activities of those engage in foreign trade and investment.

In the main, flexible rates were expected to isolate a country from monetary disturbances originating abroad and to help reconcile countries divergent rates of monetary growth. The case for exchange rate flexibility was initially built on a belief that various countries cannot, for long maintain the same inflation rate because of the undesirable but unavoidable tendency for governments to mismanage their currencies to various degrees. Differential rates adjustment and flexible exchange rates were seen to provide the least inconvenient form of adjustment. Another major argument for flexible rates was that they would make it possible for national authorities to achieve more stable rates of economic growth.

2.2. Approaches to Exchange Rate Fluctuation

The exchange rate, which is the price of a domestic currency in terms of other currencies, is usually determined in principle by the interplay of supply and demand in a free-market environment. In practice, however, no currency is allowed to float freely by the monetary authorities. Between the fixed and floating systems of exchange rate management are other regimes such as the managed and dual exchange rate regimes.

Uncertainty in exchange rates which immediately followed the collapse of the Bretton Woods system (Alaba, 2003) may be decomposed into two components. The first reflects systematic movement of the exchange rate and the second, exchange volatility (Darby *et al.*, 1999). However Hanias and Curtis (2008) noted that exchange rate like some other macroeconomic variables demonstrates chaotic elements making it difficult if not impossible to predict. There are two primary approaches of analysing the foreign exchange market: technical analysis and fundamental analysis. There is a debate on which of these two approaches is more effective in analysing exchange rate movements. While the proponents of technical analysis argue that forces of demand and supply are the determinants of exchange rate movements, fundamental analysts opine that macroeconomic indicators, asset market and political considerations are the determinants of exchange rate movements.

Lipsey and Chrystal (1995) note that fluctuation in the exchange rate is as a result of changes in demand and supply in the foreign exchange market. They opine that there are a number of factors (some of which are transitory and some are persistent) that cause shifts in demand and supply that lead to changes in exchange rate. Some of the factors mentioned are: a rise in the domestic price of exports, a rise in the foreign price of imports, change in price levels, capital movements and structural changes.

MacDonald (1997) examined the determinants of real exchange rates in a 'long-run' setting investigating the influence of fundamental factor such as: productivity and terms of trade, in addition to fiscal balances, net foreign assets and real interest rates. The study findings revealed that fundamentals do have an important, and significant, bearing on the determination of both long-run and short-run exchange rates.

In an empirical analysis of bilateral exchange rates between the US and other industrialized countries, Engel (1999)shows directly that almost all real exchange rate fluctuations are attributable to fluctuations in the international relative prices of traded goods. This result is at least consistent with the fact that real and nominal exchange rate changes are highly correlated, since real shocks to the relative price of non-traded to traded goods do not seem to matter. However, while the variability of the real exchange rate is far greater than that of the relative price of non-traded to traded goods across countries, there is also a very high simultaneous correlation between the two (Betts and Kehoe, 2005).

2.2. Empirical Review

Although, exchange rate volatility affects macroeconomic fundamentals (Chong and Tan, 2008), the sensitivity of manufacturing companies to exchange rate variations is expectedly high if they operate with an international supply chain and/or in an international market. The responsiveness of manufacturing companies/sector to exchange rate risk has been investigated extensively in the literature with various findings and assertions made. Some of these findings are reviewed below.

According to Allayannis and Ofek (1997) exchange rate variations affect manufacturing companies as its affects their expected future cash flows and therefore their value, by changing the home currency value of their foreign revenues (and costs as the case may be) and the terms of competition in the international Market. However, their empirical analysis revealed that the exchange rate exposure of manufacturing companies can be reduced significantly through extensive use of foreign currency derivatives and other hedging instruments.

Mahidhar (2006) argues that sharp and persistent variations in exchange rate will not only create discrepancies in cost and revenue models of companies that operate in the international market thereby resulting in operational and strategic risks, it also creates risk exposures across the supply chains and could as well change the competitive landscape. He noted that companies that are exposed to exchange rate risk are advised to adopt operational hedging strategies.

Dekle and Ryoo (2002) developed a model of an exporting firm that experiences fluctuating exchange rates and shocks to its cash flow. The firm uses its cash flow and borrows from the financial markets to produce for export later in the period. They noted that exchange rate and shocks to cash flows are correlated, but the correlation could be positive or negative. If, for example, they are negatively correlated, then the firm will suffer from low cash flows when its exchange rate is depreciated. That is, the firm's production will be constrained exactly at the time when its export opportunities are greatest. This provides the rationale for the firm to hedge against shocks to its cash flow.

Dekle and Ryoo (2002) related nominal exchange rates to export volumes at the firm level and finds that export volumes are strongly affected by changes in exchange rates. As in earlier work, they too found that prices are sticky in the buyer's currency. In their model of exports, the strong response of export volumes to exchange rate fluctuations arises not because of changes in the buyer's currency prices, but because of a loosening of financing constraints, either through the direct beneficial effect of exchange rate shocks on cash flows, or through hedging activities.

Dominguez and Tesar (2006) used firm- and industry-level stock returns to test for the presence of exchange rate exposure in eight countries and found that there was a significant amount of exposure to a range of different exchange rates noting that the firms affected by movements in the exchange rate and the direction of exposure depends on the specific exchange rate and varies over time. They therefore, postulated that exchange rate exposure may be linked to a number of firm- and industry-level characteristics. Their findings also revealed that exposure is more prevalent in small- (rather than large- or medium-) sized firms and in firms that engaged in international activities (measured by multinational status, holdings of international assets and foreign sales).

Sekkat and Mansour (2000) investigated sectoral sensitivity to exchange rate fluctuations in Europe and found that the most important sectors to the European economy (that is, food, paper products, chemicals, metals, machinery, electrical products and transport equipment) react differently to exchange rate changes on the side of exports and on the side of imports. Their results revealed that these sectors have, in general, a high level of sensitivity in their export as well as in their import except for transport equipments. The determinant of sectoral sensitivity to exchange rate fluctuations identified in Sekkat and Mansour (2000) study was market structure.

Fouquin *et al.* (2001) also studied the impact of the euro/dollar fluctuations on the European manufacturing industries and found that the most sensitive sectors to exchange rate fluctuations are energy, food, paper products, machinery, electrical products for imports and energy, machinery and transport equipment for exports. They identified concentration on the supply side and dynamics on the demand side to be the determinants of exchange rate sensitivity.

Cheong (2004) investigated the possible effect of risk in exchange rates on import trade in the UK using a dynamic modelling approach and found that uncertainty in exchange rates negatively affects international trade in the case of the UK and, more importantly, the effect is statistically significant. Kiptui *et al.* (2005) examined the extent of exchange rate pass-through in Kenya in order to gauge the country's vulnerability to external shocks noting that exchange rate movements are transmitted to domestic prices through prices of imported consumption goods, prices of imported intermediate goods (through production cost-channel) and domestic goods priced in foreign currency. Their study revealed that exchange rate changes account for about 70% of import price changes and 76% of the variation in import prices and they also observed that there was declining competitive pressure overtime as manufacturing output price increase outpace world export prices.

3. Methodological Issues and Sources of Data

This study considers the time series properties of the variables used. The first step is to determine the order of integration of the variables; that is, we test whether they are stationary in their levels or whether they have to be differenced once or more before they become stationary. Augmented Dickey-Fuller (ADF) test shall be used to carry out test for unit roots.

The calculated values of these statistic tests are compared with their critical values. If H_0 were accepted, for instance, a straightforward estimation of the equations in levels would yield misleading results. Therefore, we have to examine if their first difference is stationary or not. However, if H_0 is rejected for all the series, it implies that there is a possibility that the variables in levels might have a co-integrated or equilibrium relationship.

Further consideration is given to the time series properties of the variables used in the equations. This is necessary because if the variables in question are non-stationary, then the estimated models will yield misleading

values of adjusted R^2, t-statistic and F-statistic and hence the inference will not be valid (Hoque, 1993). Statistically speaking, a time series is said to be stationary if its mean, variance and covariance are all invariant with respect to time. Such a series is denoted by I(0), that is, integrated of order zero. A time series requiring first-order differencing to achieve stationary is said to be I(1). If all the variables in the equations are I(1), then, it is generally true that any linear combination of these variables will also be I(1). However, if there is a linear combination, which is I(0), then, the concerned variables are said to be co-integrated. On the other hand, if the variables are I(1), but not co-integrated, Least Square (LS) will give misleading results (Hoque and Al-Mutari, 1996). Therefore, it becomes imperative, in a study involving macro time series data to test for unit roots and co-integration before a structural relationship is estimated and reported for potential use.

Annual data coverage of thirty-four years (1980 – 2014) was used for the empirical analysis in this study. The data were collected on macroeconomic variables: Exchange rate, interest rate, inflation rate, Balance of Payment (BOP) and Gross Domestic Product (GDP). However, the investigation of the sensitivity of Nigerian manufacturing sector to exchange rate fluctuations is restricted to period between 1980 and 2014. Other data collected include: manufacturing index of ordinary shares listed on The Nigerian Stock Exchange, average manufacturing capacity utilisation rates, Average Official Exchange Rate of Naira vis-à-vis US Dollar and Nominal Effective Exchange Rate Indices. The secondary and time-series data were collected from publications of Central Bank of Nigeria (CBN) such as Statistical Bulletin, CBN Annual Report and Statement of Accounts for the years under review.

3.1. Models Specification

The main focus of this study is to investigate the sensitivity of Nigerian manufacturing sector to exchange rate fluctuations and to identify the determinants of Exchange rate in Nigeria. Therefore, the model formulation was designed to capture this study focus.

Three multiple regression models shall be used in the estimation. The ***first*** regression model shall seek to investigate the sensitivity of Nigerian manufacturing sector share index to exchange rate fluctuations. This is a follow up on previous studies that have examined the impact of exchange rate sensitivity on Turkish companies' stock returns, effect of exchange rate fluctuations on stock returns of U.S. multinationals (Choi and Prasad, 1995) sensitivity of S&P 500 non-financial firm's stock return to exchange rate exposure (Allayannis and Ofek, 1997) relationships between exchange rate and stock prices in Vietnam (Chong and Tan, 2008). The ***second model*** seeks to investigate the effect of exchange rate fluctuations on manufacturing capacity utilisation rate, which is a better measure of the performance of manufacturing companies than their share returns that is subject to speculation. The estimation period shall be restricted to the period between 1980 and 2014, that is, upto when data was available. The ***third model*** seeks to identify the determinants of exchange rate in Nigeria with data spanning from 1980 to 2014.

Thus, the model specifications are as follows:

Model I:

This is symbolically expressed as

MIS=f (EXR, NEER, RGDP)…………………………………………………………………………..3.1

Mathematical Presentation of the Model:

$MIS_t = \beta_0 + \beta_1 EXR_t + \beta_2 NEER_t + \beta_3 RGDP_t + \mu$…………………………………………………………3.2

Adopting a log-linear specification, taking the natural logarithm both sides of the equation and assuming linearity among the variables give.

$LMIS_t = \beta_0 + \beta_1 EXR_t + \beta_2 NEER_t + \beta_3 LRGDP_t + \mu$ …….………………...…………………………………………….3.3

Note that log A= B_0

Where:

LMIS= Manufacturing Index of Ordinary Shares Listed on the Nigerian Stock   Exchange for current year

EXR   =Average Official Exchange Rate of Naira vis-à-vis US Dollar

NEER =Nominal Effective Exchange Rate Indices for Nigeria

LRGDP = Real Gross Domestic Product for previous year

µ= Stochastic or Error term.

$\beta_1 - \beta_3$= Regression coefficients.

β_0 = Intercept of the function (constant term)

t= time (1980 to 2014)

Model II:

This is symbolically expressed as

MCU=f (EXR, NEER, RGDP)………………………………...……………………………………….3.4

Mathematical Presentation of the Model:

$MCU_t = \beta_0 + \beta_1 EXR_t + \beta_2 NEER_t + \beta_3 RGDP_t + \mu$…………………………………………………………………3.5

Adopting a log-linear specification, taking the natural logarithm both sides of the equation and assuming linearity among the variables give.

$LMCU_t = \beta_0 + \beta_1 EXR_t + \beta_2 NEER_t + \beta_3 LRGDP_t + \mu$ …….………………….…………………………………………3.6

Note that log A= B_0

Where:

MCU = Manufacturing Capacity Utilisation Rate for current year

EXR   = Average Official Exchange Rate of Naira vis-à-vis US Dollar

NEER = Nominal Effective Exchange Rate Indices for Nigeria

RGDP = Real Gross Domestic Product for previous year

µ= Stochastic or Error term.

$\beta_1 - \beta_3$= Regression coefficients.

β_0 = Intercept of the function (constant term)

t= time (1980 to 2014)

Model III:

This is symbolically expressed as

EXR=f (INT, INF, BOP, RGDP)……………………..…………………………………………………..3.7

Mathematical Presentation of the Model:

$EXR_t= \beta_0 + \beta_1 INT_t + \beta_2 INF_t + \beta_3 BOP_t + \beta_4 RGDP_t + \mu$……………..…………………………………………..3.8

Adopting a log-linear specification, taking the natural logarithm both sides of the equation and assuming linearity among the variables give.

$EXR_t = \beta_0 + \beta_1 INT_t + \beta_2 INF_t + \beta_3 LBOP_t + \beta_4 LRGDP_t + \mu$ …….…………………………………………………3.9

Note that log $A = B_0$

Where:

EXR = Average Official Exchange Rate of Naira vis-à-vis US Dollar

 INT = Interest Rate for current year

INF = Inflation Rate for current year

BOP = Balance of Payment surplus/deficit for current year

RGDP = Real Gross Domestic Product for previous year

μ= Stochastic or Error term

β_1- β_3= Regression coefficients.

β_0 - Intercept of the function (constant term)

t -time (1980 to 2014)

4. Data Presentation and Analysis of Result

As stated in the previous section, the estimated regression results are based on the Johansen cointegration technique and the ECM regressions. These results are presented and discussed in this section. The procedure involves the investigation and determination of the time series properties of all variables included in the regression model. The appropriate test here is the unit root test which in this case is based on the Augmented Dickey-Fuller (ADF) test which provides the framework for the determination of the order of integration of each time series and consequently the (non-) stationarity of same. As a necessary but not sufficient condition for cointegration, each of the variables must be integrated of the same order, where the order of integration must be greater than zero. The equations were estimated using the E-Views 8.1 output econometric software. The empirical results obtained from these analyses are presented and discussed in this section.

4.1.Unit Roots Test Result

In this study, the Augmented Dickey Fuller (ADF) unit roots tests were employed to test for the time series properties of the model variables. The null hypothesis is that the variable under investigation has a unit root against the alternative. The decision rule is to reject the null hypothesis if the ADF statistic value exceeds the critical value at a chosen level of significance (in absolute term). These results are presented in Table 1 below.

Table-1. Augmented Dickey-Fuller (ADF) Test for model 1, 2 and 3 respectively.

MODEL 1					
Variables	**ADF-Statistic**	**Critical Value**			**Order of Integration**
		1%	**5%**	**10%**	
MODEL 1					
LMIS	-4.374515	-3.646342	-2.954021	-2.615817	1
EXR	-5.444451	-3.646342	-2.954021	-2.615817	1
NEER	-4.199887	-3.646342	-2.954021	-2.615817	1
LRGDP	-4.954321	-3.646342	-2.954021	-2.615817	1
MODEL 2					
LMCU	-4.318123	-3.646342	-2.954021	-2.615817	1
EXR	-5.444451	-3.646342	-2.954021	-2.615817	1
NEER	-4.199887	-3.646342	-2.954021	-2.615817	1
LRGDP	-4.954321	-3.646342	-2.954021	-2.615817	1
MODEL 3					
EXR	-5.444451	-3.646342	-2.954021	-2.615817	1
INT	-8.202138	-3.646342	-2.954021	-2.615817	1
INF	-5.567472	-3.653730	-2.957110	-2.617434	1
LBOP	-6.924274	-3.646342	-2.954021	-2.615817	1
LRGDP	-4.954321	-3.646342	-2.954021	-2.615817	1

Source: Author's Computation (E-View 8.1 output).

The results of the unit root tests presented in Table 1 above suggest that all the variables are one (1) in the models 1, 2, and 3 respectively as confirmed by a test on the difference of the variables. That is, the autoregressive distributed lag (ADL) functions of the variables are of one (1) series respectively. This, as noted earlier, is done to assess the possibility of co-integration in the data and to ensure consistency in subsequent stationary econometric modelling.

4.2. Johansen Co-Integration Test

A necessary but not sufficient condition for co-integrating test is that each of the variables be integrated of the same order. The Johansen co-integration test uses two statistics tests namely; the trace test and the likelihood eigenvalue test. The first row in each of the table test the hypotheses of no co-integrating relation, the second row test the hypothesis of one co-integrating relation and so on, against the alternative of full rank of co-integration. The results are presented in Table 2 below.

Table-2. Co-integration for Trace Statistic test (Model 1, 2 and 3 respectively)

Hypothesized No. of CE(s)	Eigenvalue	Trace Statistic	Critical Value 0.05	Prob.**
MODEL 1				
None*	0.825918	139.8027	47.85613	0.0000
At most 1*	0.736129	85.60756	29.79707	0.0000
At most 2*	0.556175	44.30644	15.49471	0.0000
At most 3*	0.460393	19.12435	3.841466	0.0000
MODEL 2				
None*	0.837482	130.7382	47.85613	0.0000
At most 1*	0.672447	74.41221	29.79707	0.0000
At most 2*	0.512881	39.81290	15.49471	0.0000
At most 3*	0.431663	17.51624	3.841466	0.0000
MODEL 3				
None*	0.860712	203.3413	69.81889	0.0000
At most 1*	0.800845	142.2337	47.85613	0.0000
At most 2*	0.717290	92.20993	29.79707	0.0000
At most 3*	0.627902	53.04664	15.49471	0.0000
At most 4*	0.514503	22.40006	3.841466	0.0000

Source: Author's Computation (E-view 8.1 Output)

In the model one and two above, the results of the co-integration test are reported here. The trace-statistic value is shown to be greater than the critical values at both 1% and 5% levels, thus indicating 4 co-integrating equation at both 1% and 5% levels respectively and model three indicating 5 co-integrating equation at both 1% and 5% level. The existences of co – integration suggest that there is a long – run relationship between the variables under consideration. Having established co– integration among the variables, we moved on to the ECM which will help us to see the short –run dynamics of the model. ECM will enable us determine the speed of adjustment from short – run to long – run equilibrium.

Table-3. The Result of Error Correction Model (ECM) for model 1, 2, and 3 respectively

Dependent Variable: LMIS				
Method: Least Squares				
Date:11/24/15Time: 08:16				
Sample (adjusted): 1980 2014				
Included observations 43				
MODEL 1				
Variable	Coefficient	Std. Error	t-statistic	Prob.
C	-5.051680	0.467350	-10.80921	0.0000
EXR	0.001690	0.002788	0.606264	0.5491
NEER	0.007649	0.001738	4.399731	0.0001
LRGDP	1.269119	0.071707	17.69867	0.0000
ECM(-1)	-0.710254	0.135248	-5.251484	0.0000
R-Squared: 0.993183; F-statistic: 1056.344; Prob(F-statistic): 0.000000; Adjusted R-squared: 0.992243; Durbin-Watson Stat: 1.752160				
MODEL 2				
C	4.360039	0.210435	20.71914	0.0000
EXR	0.005715	0.001257	4.546132	0.0001
NEER	0.001310	0.000785	1.668508	0.1060
LRGDP	-0.128757	0.032267	-3.990352	0.0004
ECM(-1)	-0.669314	0.137068	-4.883067	0.0000
R-Squared: 0.813089; F-statistic: 31.53861; Prob(F-statistic): 0.000000; Adjusted R-squared: 0.787309; Durbin-Watson Stat: 1.716392				
MODEL 3				
C	-124.3552	16.37984	-7.591966	0.0000
INT	-0.481253	0.867068	-0.555035	0.5833
INF	-0.631065	0.192085	-3.285336	0.0027
LBOP	0.909174	1.474333	0.616668	0.5424
LRGDP	25.69297	1.911899	13.43846	0.0000
ECM(-1)	-0.731774	0.132207	-5.535077	0.0000
R-Squared: 0.941161; F-statistic: 89.57454; Prob(F-statistic): 0.000000; Adjusted R-squared: 0.930654; Durbin-Watson Stat: 1.644626				

Source: Author's Computation (using E-View 8.1 Output).

4.3. Interpretation of Result
Analysis of Regression Coefficients:
Model 1:
- ❖ Exchange rate (EXR) has a coefficient of 0.001690. This implies that a unit increase in EXR will bring about an increase in the manufacturing index of ordinary Shares listed on the Nigerian stock exchange for current year by 0.169 units. And it is also significant at 5% level for the period under review.
- ❖ Nominal Effective Exchange Rate Indices (NEER) is seen to have a coefficient of 0.007649. This shows that a unit change in NEER will increase the manufacturing index of ordinary shares listed on the Nigerian stock exchange for current year by 0.76 units. And it is also significant at 5% level for the period under review.
- ❖ Real gross domestic product (LRGDP) has a coefficient of 1.269119, which implies that a unit increase in real gross domestic product will result to an increase of the manufacturing index of ordinary shares listed on the Nigerian stock exchange for current year by 126.9 units and significant at 5% level for the period under review.
- ❖ The coefficient of the constant is -5.051680, implying that when all other independent variables are held constant; the value of the dependent variable (LMIS) will be 505.168%. And it is also significant at 5% level for the period under review.

Model 2:
- ❖ Exchange rate (EXR) has a coefficient of 0.005715. This implies that a unit increase in EXR will bring about an increase in the manufacturing capacity utilization rate for current year by 0.57 units. And it is also significant at 5% level for the period under review.
- ❖ Nominal Effective Exchange Rate Indices (NEER) is seen to have a coefficient of 0.001310. This shows that a unit increase in NEER will about an increase the manufacturing capacity utilisation rate for current year by 0.131 units. And it is also significant at 5% level for the period under review.
- ❖ Real gross domestic product (LRGDP) has a coefficient of -0.128757, which implies that a unit increase in LRGDP will result to a decrease of manufacturing capacity utilisation rate for current year by 12.8757% units. And it is also significant at 5% level for the period under review.
- ❖ The coefficient of the constant is 4.360039, implying that when all other independent variables are held constant; the value of the dependent variable (LMCU) will be 436.0%. And it is also significant at 5% level for the period under review.

Model 3:
- ❖ Interest rate (INT) has a coefficient of -0.481253. This implies that a unit decrease in interest rate will bring about a decrease in the exchange rate by -48.1 units. And it is also insignificant at 5% level for the period under review.
- ❖ Inflation Rate (INF) is seen to have a coefficient of -0.631065. This shows that a unit change in inflation rate will decrease the exchange rate by -63.1 units. And it is also significant at 5% level for the period under review.
- ❖ Balance of payment (LBOP) has a coefficient of 0.909174, which implies that a unit increase in balance of payment will result to an increase in the exchange rate by 90.9 units. And it is also significant at 5% level for the period under review.
- ❖ Real gross domestic product (LRGDP) has a coefficient of 25.69297, which implies that a unit increase in real domestic product will result to an increase of the exchange rate by 2569.297 units. And it is also significant at 5% level for the period under review.
- ❖ The coefficient of the constant is -124.3552, implying that when all other independent variables are held constant; the value of the dependent variable (EXR) will be 12435.5%. And it is also significant at 5% level for the period under review.

The statistical significance of the parameter estimate can be verified by standard error test; the adjusted R squared and Durbin Watson statistics.
- ❖ For the models, when compared half of each coefficient with its standard error, it was found that the standard errors are less than half of the values of the coefficients of the variables. This shows that the estimated values are all statistically significant.
- ❖ From the results of our regression R^2 for models are 0.993183, 0.813089 and 0.941161 respectively. This shows that almost 99.3%, 81.3% and 94.1% of the changes in the dependent variables were captured by the independent variables in both models, respectively.
- ❖ The value of Durbin Watson is 1.7, 1.7 and 1.6 respectively in the models. By implication, there is evidence of positive serial correlation among the explanatory variables in the models.
- ❖ The coefficient of error correction mechanism (ECM) is negative. This is in line with economic and econometrics expectations. The error correction mechanism corrects 71.0%, 66.9% and 73.1% respectively of the total error that occurs in the models.

5. Conclusion and Recommendations
In this study, attempt was made to examine exchange rate sensitivity and its determinants with special focus on the Nigerian manufacturing sector. In essence, the study sought to answer the questions: (1) How volatile has the exchange rate of Nigeria been over the years? (2) To what extent is the Nigerian manufacturing sector sensitive to exchange rate fluctuations?, and (3) What are the macroeconomic factors that are responsible for the exchange rate fluctuations in Nigeria?

The empirical analysis revealed that post-SAP era has witnessed persistent increase and volatility in the exchanges rates. Therefore, it can be said that the exchange rates of Nigeria in post-SAP has been characterized by

uncertainty. Apart from objectives not realized, exchange rate policy and management under SAP have left some issues unresolved and/or created some distortions in the economy.

The econometric results show that the Nigerian manufacturing sector is not sensitive to exchange rate fluctuations in the long-run. Although a short-run relationship was found between the Manufacturing Index of Ordinary Shares Listed on The Nigerian Stock Exchange and the exchange rate, the same cannot be said of Manufacturing Capacity Utilisation Rate.

Furthermore, the major determinants of exchange rates of Nigeria identified in the study are inflation rate and Gross Domestic Product. But contrary to theoretical underpinning, interest rate and Balance of Payments were insignificant in the determination of exchange rate in the country.

One clear conclusion which emerged from the above analysis is that parallel market exchange rate seems a more important driver of activities in the Nigerian economy. Proper management of exchange rate, to forestall costly distortions, constitutes an important pillar in enhancing the performance of the manufacturing sector in Nigeria. It is important that monetary authorities ensure transparency in determining exchange rate process such that various economic distortions associated with exchange rate may be minimized. Perhaps the most important contribution of this study to the literature is to suggest that exchange rate volatility is not a serious source of worry for Nigerian manufacturers. The study also confirms the lingering controversy in the literature that the direction of effects of exchange rate volatility remains controversial as in the literature.

Based on the findings of this study, the following recommendations are hereby suggested:

1. The monetary authorities should maintain stability of the exchange rates through proper management so as to encourage local production. When there is no uncertainty in the foreign exchange market and undue risk, the confidence of foreign investors and the exporters would be boosted and this will consequently stimulate productivity in the manufacturing sector.
2. The monetary authorities must endeavour to force the interest rate down and continue to advocate for priority lending to the manufacturing firms. There have been massive closure of manufacturing firms in the country in recent times due to the high cost of lending; lack of long-term fund and the poor state of infrastructural facilities especially the epileptic power supply.
3. The government must continue to discourage importation in order to maintain exchange rate stability. Import substitution strategy should be vigorously pursued by the government while zero tolerance is enforced on illegal importation.
4. Lastly, Foreign Exchange should be made available to manufacturing firms so that they could source for raw materials. Furthermore, the short supply of foreign exchange in the country has been found to be as a result of the country's over-dependence on oil as the major source of foreign exchange earnings. To solve this problem, alternative sources of foreign exchange should be sought through a concrete export diversification programme.

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