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Effect of Currency Fluctuations on the Economic Growth Potential of Nigeria

Jerumeh T.R Akinribido B.B *Popoola O.A. Oke M.A Ogunnubi C. Okoruwa V.O
Department of Agricultural Economics, University of Ibadan, Ibadan, Nigeria

Abstract
The exchange rate is one of the most important determinants of a country's relative level of economic health. This study examines the effect of currency fluctuations on the economic growth potential of Nigeria using the World Bank Development Indicators data from 1970-2012. The study through the Augmented Dickey Fuller (ADF)/ unit root test found that the variables used in the model are integrated of the order one while export and interest rate are integrated of the order zero. Using the Johansen co integration tests shows the presence of long run relationship between variables. The Error Correction Model (ECM) results suggest that exchange rate has a negative significant impact on GDP in the short run and long run. The study therefore recommends that the competitiveness and stability of the exchange rate should be given due consideration as this will increase economic growth through increased investment.
Keywords: Exchange rate, Economic growth, ADF, ECM, Nigeria

1. Introduction

Currency fluctuations are a natural outcome of the floating exchange rate system that is the norm for most major economies. There has been an ongoing debate on the appropriate exchange rate policy in developing countries. Exchange rate is the rate at which a unit of the currency of one country can be exchanged for a unit of the currency of another country. It determines the relative prices of domestic and foreign goods, as well as the strength of external sector participation in the international trade (Adeniran et. al, 2014). Exchange rate regime and interest rate remain important issues of discourse in the International finance as well as in developing nations (Obansa et. al, 2013) and the choice of exchange rate regime stands as perhaps the most contentious aspect of macroeconomic policy (Calvo and Reinhart, 2002).

Exchange rate fluctuations in emerging markets, which has become more pronounced in the last two decades, have had significant impact on the economies of the affected countries. Empirical evidences have shown that exchange rate volatility in turn is caused by both real and financial aggregate shocks (Calvo and Reinhart, 2002). Adam, (2002) opined that these shocks are engendered largely from collapse of commodity prices in the world market, reduced foreign lending and increased cost of external borrowing. The volatility of exchange rates in developing countries is widely contended as being one of the main sources of economic instability around the world (Adeoye and Atanda, 2012). Conversely, fluctuations in the currency strength of major economic powers like United States drive considerably the impact of the global economy on budding economies like Nigeria. In recent years, these fluctuations have been enormous, volatile and frequently unrelated to underlying economic fundamentals (Philippe et al., 2006).

Fluctuations in exchange rate has different implications on the economic growth as measured by key macroeconomic variables. The right choice of exchange rate regime will bring an economy back to the equilibrium and many economists claim that it is one of the factors for the positive economic development (Saqib, 2013). Previous research on the impact of exchange rate has reached contrasting results- currency depreciation could have expansionary or contractionary effect on economic growth. As demonstrated by Guittian (1976) and Dornbusch (1988), the success of currency depreciation in promoting trade balance largely depends on switching demand in the proper direction and amount, as well as on the capacity of the home economy to meet the additional demand by supplying more goods.

Rodrik (2007b), in his growth models for free market, reveals that when economic distortions (market deficiencies and/or weaknesses in the institutions) hit the exchangeable goods sector harder than the non-exchangeable goods sector the depreciation in the real exchange rate acts as an incentive to invest in the primary sector and so becomes a 'second best' instrument for offsetting the cost of these various distortions, as differentiated according to the different sectors of activity. Bruno (1979) and van Wijnbergen (1989) postulate that in a typical semi-industrialized country where inputs for manufacturing are largely imported and cannot be easily produced domestically, firms' input costs will increase following a devaluation. Gylfason and Schmid (1983) provide evidence that the final effect depends on the magnitude by which demand and supply curves shift because of devaluation. However, a long term fluctuation of the real exchange rate from the nominal rate can lead to severe macroeconomic imbalances, lead to speculation attack and against the orthodoxy of macroeconomic parities.

In Nigeria, the exchange rate policy has undergone substantial transformation from the immediate post-independence period when the country maintained a fixed parity with the British pound, through the oil

boom of the 1970s, to the floating of the currency in 1986, following the near collapse of the economy between 1982 and 1985 period (Dada and Oyeranti, 2012). The exchange rate of the naira was relatively stable between 1973 and 1979 during the oil boom era, a period when agricultural products accounted for more than 70% of the nation's gross domestic products (GDP) (Ewa, 2011). However, as a result of the development in the petroleum oil sector in 1970's, the share of agriculture in total exports declined significantly while that of oil increased. However, from 1981 the world oil market started to deteriorate and its attendant economic crises were evident in Nigeria because of the country's heavy dependence on oil sales for export earnings. To underscore the central role of oil revenue to Nigerian economy, the nation's budgeted revenue and expenditure witnessed significant cuts when oil price fell from a peak of $147 in 2008 to about $37.81 per barrel (Oriakhi and Iyoha, 2010).

Between 1978 and 1982, there was an upsurge of exchange rate which was due to the introduction of both managed float and dollar pegged systems of exchange rate policies in the country (Ettah *et al.,* 2011). Apart from this policy measures, the Central Bank of Nigeria (CBN) applied the basket of currencies approach from 1979 as the guide in determining the exchange rate. Exchange rate was determined by the relative strength of the currencies of the country's trading partner and the volume of trade with such countries. Specifically weights were attached to these countries with the American dollars and British pound sterling on the exchange rate mechanism (CBN, 1994).

The adoption of the International Monetary Fund (IMF) Structural Adjustment Programme (SAP) in 1986 resulted in the transition from fixed exchange rate regime to floating exchange rate regime in Nigeria (Adeoye and Atanda, 2012). Under this system, instead of determining exchange rates by market forces, a managed float system was adopted whereby monetary authorities intervened periodically in the foreign exchange market in order to attain some strategic objectives (Mordi, 2006). This inconsistency in policies and lack of continuity in exchange rate policies aggregated unstable nature of the naira rate (Gbosi, 2005). Ever since, the exchange rate of naira vis-à-vis the U.S dollar has attained varying rates all through different time horizons. For example, exchange rate in Nigeria averaged 138.47 from 2003 to 2013, reaching an all time high of 230 in 2015 and a record low of 2.02 in 1986 (CBN, 2013).

In recent times, the fall in the exchange rate has been attributed to fall in oil price which resulted in a continuous and heavy depletion of the country's external reserve, a strategy employed by Central Bank of Nigeria (CBN) to defend the naira. The CBN governor, Mr Godwin Emefiele, revealed that Nigeria is being faced with a number of challenges which compelled the devaluation of naira. These factors include fall in the global oil prices, the end of the United States Quantitative Easing programme, the discovery of shale oil by the US and the global fall in the price of other export commodities apart from the crude oil (Gabriel and Ujah, 2014). The fall in the global oil prices has led to a decline in oil revenue from which the nation derives 95 per cent of its foreign exchange. Consequently, her external reserves had fallen by over 20 per cent from $43bn a year ago to $34.4bn by January 22, 2015 (Oleh, 2015). It has also been observed that Nigeria had faced a simultaneous dwindling in the supply of the dollar and rise in its demand. Consequently, this has led to led to a rise in the price of the dollar at both the interbank and Bureau De Change segments of the market. All these have been observed to constitute to the low supply of the US dollars amid high demand for them.

Benson and Victor, (2012) and Aliyu, (2011) noted that despite various efforts by the government to maintain a stable exchange rate, the naira has depreciated throughout the 80's till date. It is against this backdrop that this study seeks to establish the effect of the unremitting exchange rate depreciation experienced in Nigeria on key macroeconomic variables over a period of 43 years (1970 – 2013). As the exchange rate continues to increase at a geometric rate (with the current exchange rate pegged at 1dollar to ₦200 and still wavering), what policy implication does this have on the economic growth of Nigeria? Would it in any way promote domestic production? Or would the profit from domestic production be offset by higher costs of imported inputs? Is there a possibility that measures are being taken to stabilize the exchange rate so that currency fluctuations will smooth out over time? Or is exchange rate fluctuation a necessary "evil" or "good" we have to live with? This paper provides an overview of the methods and issues arising in each case, and presents empirical work in the area of currency fluctuations, including policy implication of the research findings

2. Literature Review

Previous research on the impact of currency fluctuation and economic growth shared different views about their relationship. While some believed currency fluctuation is detrimental to growth through its harmful effect on consumption and investments others claimed it is beneficial and a necessary condition for growth as it aids competitiveness and growth of domestic production sector. However some researchers also claimed that currency fluctuation has no significant effect on economic growth.

Empirical evidence has showed that real exchange rate variations can affect growth outcomes. Faster economic growth and significant growth in agricultural exports (cocoa) in Nigeria is significantly associated with exchange rate fluctuations and therefore there should be a free market determination of exchange rate for export of cocoa in Nigeria (Ettah et al, 2011). It has been found that exchange rate liberalization is good to

Nigerian economy as it promote economic growth. Obansa et al., (2013) examined the relationship between exchange rate and economic growth in Nigeria between 1970 and 2010. The result indicated that exchange rate has a strong impact on economic growth.

On the contrary, some past studies showed that exchange rate has no significant effect on economic growth performance. From the literatures, it is particularly clear that this exchange rate uncertainty is having a negative effect on economic operators, curbing investment and slowing growth. The Commission of European Communities discovered that currency fluctuation and the sudden changes in current or anticipated profitability stemming from it have engendered uncertainty and a wait-and-see attitude among economic agents, leading to a slowdown in growth (Commission of the European Communities, 1995). Similarly, both real exchange misalignment and volatility adversely affected growth of Nigerian non-oil exports in Nigeria (Ogun, 2006). Kandil, (2004) found that for a varying degree of openness, exchange rate fluctuations generate adverse effects on economic performance in a variety of developing countries. These effects are evident by output contraction and price inflation in the face of currency depreciation. In same vein, anticipated appreciation of the exchange rate, current and lagged, has a negative effect on output growth in Turkey. Specifically, unanticipated exchange rate depreciation in 1994 and 2001 correlated with a reduction in real output growth (Kandil et al., 2007)

Eme and Johnson (2012) found no evidence of a strong direct relationship between changes in exchange rate and output growth. Rather, he concluded that Nigeria economic growth has been directly affected by monetary variables.

3. Data and methodology

3.1 Data sources

Data used for this study were obtained from the World Bank Development Indicators. The study covered a period of 42 years (1970-2012). Annual data on exchange rate (EXRATE), imports (IMP), exports (EXP), interest rate (INT), inflation (INF), foreign direct investment (FDI) and gross domestic product (GDP) were collected from the mentioned source.

3.2 Analytical technique

This study aimed at determining the relationship among gross GDP used as a proxy for economic growth and other macroeconomic variables as listed above in Nigeria. The use of time series data for analysis demands the investigation of presence of unit root in the data. This is to avoid spurious regression. The Johansen co-integration test and error correction model (ECM) were employed to examine the long-run relationship and the stability of the equilibrium among GDP and other listed macroeconomic variables in Nigeria. The estimation procedure takes the following forms:

3.3 Unit Root Test

Given that the initial step in carrying out a time series analysis is to test for stationarity of the variables (in this case, exchange rate (EXRATE), imports (IMP), exports (EXP), interest rate (INT), inflation (INF), foreign direct investment (FDI) and gross domestic product (GDP).

A series is said to be stationary if the means and variances stay constant over time. It is denoted as I(0), meaning integrated of order zero. Non stationary stochastic series have changing mean or time varying variance. All the variables used in this study were first tested for stationarity. The rationale was to overcome the problems of spurious regression. A stationary series tends to always return to its mean value and variations around this mean value. A variable that is non-stationary is said to be integrated of order *d*, written as *I(d)*, if it must be differenced *d* times to be made stationary. In the same way, a variable that has to be differenced once to become stationary is believed to be *I(1)* that is integrated of order I(1).

According to Gujarati (2003), the Augmented Dickey Fuller (ADF) test entails running a regression of the form:

$$\Delta Z_t = \beta_1 + \beta_{2t} + \delta Z_{t-1} + \sum_{t-1}^{m} \alpha_1 \Delta Zt - 1 + \varepsilon_t \qquad (1)$$

Where Δ= the change operator; Z_t = variable series (exchange rate (EXRATE), imports (IMP), exports (EXP), interest rate (INT), inflation (INF) and gross domestic product (GDP) being investigated for stationarity); Z_{t-1} = lagged values of variables; t = time variable and ε_t is the white noise error.

The null hypothesis that $\delta = 0$ means existence of a unit root in Z_t or that the time series is non-stationary. The decision rule is that if the computed ADF statistics is greater than the critical at the specified level of significance, then the hull hypothesis of unit root is accepted otherwise it is rejected. In other words, if the value of the ADF statistics is less than the critical values, it is concluded that Z_t is stationary i.e $Z_t \sim$ I(0). When a series is found to be non-stationary, it is first-differenced (i.e the series $\Delta Z_t = Z_t - Z_{t-1}$ is obtained and the ADF test is repeated on the first-differenced series. If the null hypothesis of the ADF test can be rejected for the first-differenced series, it is concluded that $Z_t \sim$ I(1).

3.3 Johansen's Co integration test

The Johansen's co-integration tests are very sensitive to the choice of lag length. Firstly, a VAR model is fitted to the time series data in order to find an appropriate lag structure. The Akaike Information Criterion (AIC) was used to select the number of lags required in the co-integration test. The lagged terms are included to ensure that the errors are uncorrelated. The number of lagged difference terms to be included can be chosen based on t-test, F-test or the Akaike's Information Criterion (AIC) (Greene, 1993).The null hypothesis is that the variable y_t is a non-stationary series (H_0: $\beta = 0$) and is rejected when â is significantly negative (H_a: $\beta<0$). The null hypothesis is that the variable y_t is anon-stationary series (H_0: $\beta = 0$) and is rejected when β is significantly negative (H_a: $\beta<0$). If the calculated ADF statistic is higher than McKinnon's critical values, then the null hypothesis (H_0) is not rejected and the series is non-stationary or not integrated of order zero I(0).

3.4 Engle-Granger Error Correction procedure

This study employed the Engle and Granger (1987) approach to ECM which consist of three steps: the first step is the estimation of the co-integrating regression as shown in equation (1):

$$Y_t = \alpha + \delta X_t + e_t \quad (1)$$

From these estimate, the residual term was generated

$$\hat{e}_t = Y_t - \hat{a} - \hat{\lambda} X_t \quad (2)$$

and the residual term was included in the short term equation as shown in equation (3):

$$\Delta Y_t = \beta \Delta X_{t-1} - \rho \hat{e}_{t-1} \quad (3)$$

Where

Y_t= dependent variable; X_t= explanatory variables; e_t= residual error term; $\hat{e}_t$= estimated residual term; $\hat{e}_{t-1}$ = error correction term.

Model specification

GDP = f (EXRATE, IMP, EXP, INT, INF, ECT)

Variables are defined as follows:

GDP- Gross Domestic Product; EXRATE- Exchange Rate; IMP- Imports; EXP- Exports; INT- Interest rate; INF- Inflation, ECT- Error Correction Term.

4. Results and discussion

4.1 Unit root test/ Stationarity Tests and Johansen Co-integration test

For co-integration analysis, it is important to check the unit roots at the outset to ascertain whether modeled variables are I (0) at levels and I (1) at differences. The results of the Unit Root Test using the Augmented Dickey- Fuller (ADF) is presented in table 1. The tests were applied to each variable over the period of 1970-2012 with a time trend at the variables level and at their first difference. The test results were compared against the MacKinnon (1991) critical values for the rejection of the null hypothesis of no unit root. Results showed that all variables were non-stationary in levels and stationary in first differences. This indicates that the variables are I(1) and any attempt to specify the dynamic function of the variable in the level of the series will be inappropriate and may lead to problems of spurious regression in line with Mesike et al. (2010). The econometric results of the model in that level of series will not be ideal for policy making (Yusuf and Falusi, 1999) and such results cannot be used for prediction in the long-run (Obayelu and Salau, 2010). Johansen cointegration test therefore became appropriate for assessing the existence of long-run relationships among variables.

The Akaike Information Criterion (AIC) was used to select the optimal truncation lag length to ensure the errors are white noise in ADF. In this study, the Akaike Criterion (AIC) suggested an optimal lag length of 3 which is the appropriate specification for the order of VAR model.

The summary results of the Johansen's Maximum Likelihood co-integration test presented in table 2 was based on the both the trace test and maximum Eigen value test, which showed the existence of three cointegrating vectors and the rejection of the null hypothesis of r = 0. Thus, there is a unique long-run equilibrium relationship between the variable concerned in line with Hallam and Zanoli (1992) that state that where only one co-integrating equation exists, its parameters can be interpreted as estimate of long-run co-integrating relationship between the variables concerned. Since all variables are co-integrated, then the VECM was estimated.

4.2 Error Correction Model Estimates: Long run estimates and Short-run estimates

The existence of co-integration among the dependent variable and their fundamentals necessitated the specification of ECM for this study. The residual of the model was stationary (test statistics -3.84) at 10% using the absolute critical value of Engle Granger test (-3.04). As a result, the estimated model is not spurious. This implies that the variables are co integrated and there exist a long run relationship. Thus, the model is long run model. The ECM estimates for effects of exchange rate fluctuations on economic growth (GDP) in Nigeria is

presented in table 3. It is observed that exchange rate, export, import and inflation have significant effect on GDP at different levels of significance. The estimate reveals that there is a significant long-run relationship between exchange rate and GDP. The result indicates that exchange rate fluctuations had a negative impact on economic growth from 1970-2012. This is consistent with the findings of Arize et al., 2000; Aghion et al., 2009 and David et al., 2010. However, positive significant relationship existed among the export and import variables with GDP while there was a negative relationship between economic growth and inflation on the long run between the periods under review.

Another issue discussed in this study was to determine whether there is a short-run causality running from the independent variables to economic growth (GDP). An error correction term (ECT) model for short-run behaviour was established and the results are presented in Table 4. The coefficient of the error correction term which measures the speed of adjustment towards long-run equilibrium was negative, significant at 1% level which is appropriate (ECM is -0.776). One important finding is the statistical significance of the ECM suggesting that GDP adjusted to correct long run disequilibrium between itself and its determinants. This coefficient of the ECM revealed that the speed with which GDP adjusted to exchange rate and other determinants. The estimation results revealed that increase in exchange rate had a negative impact on GDP in the short run. Also, interest rate had a negative impact on GDP while export had the expected positive significant impact on GDP both in the short run. The residual test was checked for serial correlation. The result showed that the p-value was 0.8111 which is greater than 5%, meaning that the model was not suffering from serial correlation and alternative hypothesis of presence of serial correlation can be rejected. Also, the Breusch-Pagan-Godfrey (BPG) test also showed no presence of heteroskedasticity and finally the Jarque-Bera normality test statistics indicates that the residual of the model was normally distributed (p-value of 0.8479).

5. Conclusion and recommendation

This study investigated the effect of currency fluctuations on the economic growth potential in Nigeria over a period of 1970-2012 through the co integration and the ECM approach. The co integration test showed that there was a long run relationship between the variables. Evidence suggested that exchange rate by has a negative significant impact on GDP in the short run and long run. A possible explanation is that increases in the fluctuations in exchange rate lead to decrease in aggregate output probably due to instability experienced during the period under review. It can be concluded that exchange rate fluctuations is an important variable affecting aggregate economic output of the country. It is recommended that efforts should be directed at maintaining a stable and competitive exchange rate.

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Table 1: Augmented Dickey Fuller (ADF) test

Variable	ADF Tau Statistics	Order of integration	ADF Tau Statistics	Order of integration
GDP	-2.5980(-2.9458)	I(0)	-8.4221 (-2.9389)	I(1)
EXRATE	-0.5042 (-2.9331)	I(0)	-5.9544 (-2.9350)	I(1)
IMP	-0.2840 (-2.9331)	I(0)	-5.7357 (-2.9350)	I(1)
EXP	-1.7914(-2.9458)	I(0)	-6.2539(-2.9434)	I(1)
INT	-6.8037 (-2.9332)	I(0)	-8.0589(-2.9369)	I(1)
INF	-3.2350(-2.9332)	I(0)	-6.5834 (2.9369)	I(1)

Note: Values in parenthesis are *5% Mackinnon critical values*
I (1): Integrated of order 1; I (0): Integrated of order zero

Table 2: Johansen Cointegration Test

Null Hypothesis	Alternative hypothesis	Eigen value	Trace Statistics(λ_{trace})	5% critical value
r=0*	r≥1	0.909178	217.6893	95.75366
r≤1*	r≥2	0.840928	124.1342	69.81889
r≤2*	r≥3	0.515991	52.43665	47.85613
r≤3	r≥4	0.267962	24.13620	29.79707
r≤4	r≥5	0.217534	11.97120	15.49471
r≤5	r≥6	0.059788	2.404325	3.841466

Null Hypothesis	Alternative hypothesis	Eigen Value	Maximum Eigen Statistics (λ_{max})	5% critical value
r=0*	r>1	0.909178	93.5552	40.0775
r≤1*	r> 2	0.840928	71.6975	33.8769
r≤2*	r> 3	0.515991	28.3005	27.5843
r≤3	r> 4	0.267962	12.1650	21.1316
r≤4	r> 5	0.217534	9.56688	14.2646
r≤5	r> 6	0.059788	2.40432	3.84147

*Note: *denotes rejection of null hypothesis at 5% level. Both Trace test and max- eigen value tests indicate the presence of 3 cointegrating equations at the 0.05 level*

Table 3: Results of Error Correction Model showing long run effects

Variables	Coefficient	Standard error	t-statistics
EXP	0.5074***	0.1291	3.9295
EXRATE	-0.0531*	0.0283	-1.8785
IMP	0.3443***	0.1268	2.7156
INF	-0.0059**	0.0027	-2.1859
INT	-0.0037	0.0028	-1.3080
C	5.1004***	1.2079	4.2226

****, **,* denotes 1%, 5% and 10% significant levels respectively*

Table 4: Results of Error Correction Model showing short run effects

Variables	Coefficient	Std. Error	t-Statistic
D(EXP)	2.499***	0.3014	8.2907
D(EXRATE)	-4.5103**	1.8354	-2.4574
D(IMP)	0.4035	0.3873	1.0418
D(INF)	-1.5900	1.8712	-0.8497
D(INT)	-4.8100***	1.3014	-3.6862
(U-1)	-0.7763***	0.1986	-3.9101
C	1.7219	3.1213	0.5500
R-squared	0.7659806	Akaike info criterion	50.16514
Adjusted R-squared	0.725862	Schwarz criterion	50.45476
Log likelihood	-1046.468	Hannan-Quinn criterion	50.27130
F-statistic	19.09328	Durbin-Watson stat	2.008802
Prob(F-statistic)	0.000000	Jarque-bera	0.8479
B-P-G test	0.9683	B-G LM test stat	0.8111