Quantitative Analysis of the Impact of Exchange Rate Policies on Nigeria's Economic Growth: a Test of Stability of Parameter Estimates

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Abstract

Exchange rate policy in Nigeria has oscillated from a fixed exchange rate regime in 1960, and to a pegged regime between 1970s and mid 1980s and finally to various variants of the floating regime from 1986 with the introduction of the Structural Adjustment Programme (SAP). This study tested the impact of the two basic exchange rate policies, namely, the fixed and flexible regimes, using the Chow test procedure to determine the structural stability of the relationship between exchange rate and output of goods and services during the two regimes. However, before the Chow test was applied, the time series characteristics of the variables used in the model were tested, using Augmented Dickey-Fuller unit root tests and Johansson co integrating tests. All the variables were integrated of order one, and co integrated. The estimated long run equation revealed that, apart from government expenditure (GEX), both exchange rate (EXR) and money supply (M_2) are highly significant in the determination of Nigeria's economic growth performance. The adjusted R-square value of about 0.85 was considerably high implying that about 85% of the variability in Nigeria's economic growth performance is determined by the regressors. The joint influence of the explanatory variables measured by the F-value of 76.19601 is also highly significant. The D-W value of 0.288965 indicated the presence of autocorrelation of the first order. The conducted Chow test showed that the relationship between exchange rate and economic growth performance in Nigeria have not undergone any significant structural changes. The implication is that no matter the exchange rate regime, whether fixed or flexible, what matters is the effectiveness of the management. Nigeria can substantially improve on its economic growth performance through improvements in the overall management of its exchange rate policy.

Keywords: Exchange Rate, Deregulation, Co integration, Equilibrium, Bonds, Depreciation

Introduction

Any country that has its own currency must decide what type of exchange rate arrangement to maintain. Exchange rate arrangements are broadly classified into three namely, fixed or pegged arrangements, flexible arrangements, and in-between category of arrangements with "limited flexibility". Each variety or alternative have different implications which determines the extent to which countries participate in foreign exchange markets. When a monetary authority decides to fix exchange rates against other currencies, they make a commitment to intervene in the market, buying and selling their currency whenever necessary to keep the exchange rate from changing. When, on the other hand, the monetary authority abstains completely from intervening in the market for exchange rates, they are choosing to let their exchange rates float freely.

In practice, by controlling the extent to which, and conditions under which, they intervene in exchange markets, Peter (1997), states that countries may attempt to manage their exchange rates with essentially any degree of flexibility they desire.

Exchange rate policies aim at evolving real exchange rate (RER) that maintains internal and external balance in any economy. Internal balance is defined in terms of the level of economic activities consistent with satisfactory control of inflation and full employment of resources. External balance on the other hand is defined in terms of Balance of payments equilibrium or sustainable current account deficit financed on a lasting basis by expected capital inflows (Pondexter,(1981) and Dernbourg, 1980). Improvements in the international competitive strength of any country lean heavily on the real exchange rates. The implication of this is very clear: any distortions in the real exchange rate will most probably lead to distortions in both internal and external balances.

One of the major goals of macroeconomic policy is rapid economic growth. As demonstrated by Zuvekas (1979), economic growth is measured by increase in output of goods and services overtime, and as stated by Akpan (2008), economic growth is said to occur when a country's productive capacity is on the increase. Production of goods and services involve exports and imports which in turn involve transactions in foreign exchange, and exchange rate has been characterized by instability which has raised concern about its effect on economic growth.

In view of the fact that exchange rate policy in Nigeria has oscillated basically between the fixed exchange rate system since the immediate post independence era in 1960 and then from 1986 when a market based exchange rate system was introduced in the context of the structural Adjustment Programme (SAP), there has been a controversy as regards output of goods and services under the flexible exchange rate system and under the fixed exchange rate system. While Emeh and Johnson (2010) insist that flexibility in exchange rates does not have any relationship either directly or indirectly on the growth of output in Nigeria, Edwards and Levy-Yeyati (2003) contend that countries with more flexible exchange rate systems grow faster than countries with fixed exchange rate regimes.

It is the aim of this paper to investigate, using Chow Test analytical procedure to determine the performance of the economy under the fixed and flexible exchange rate regimes in Nigeria for the sample period 1970 to 2011. This paper is organized into ***Six*** sections, including this introductory section. The second section is a review of exchange rate policies in Nigeria. The third section is review of the relevant theoretical and empirical literatures. The fourth section is the model specification followed by the fifth section which provides the analysis and interpretation of the empirical results. Finally, is the summary, conclusion,and policy recommendations

2. Review of Exchange Rate Policies in Nigeria

Exchange rate policy in Nigeria has undergone a good number of changes. It has developed from a fixed parity in 1960 when it was solely tied with the British Pound Sterling. By 1967, following the devaluation of the Pound Sterling the US dollar was included in the parity exchange. In 1972, the parity exchange with the British Pound was suspended as a result of the emergence of a stronger US dollar.

In 1973, Nigeria reverted to a fixed parity with the British Pound following the devaluation of the US dollar. In 1974, in order to minimize the effect of devaluation of a single individual currency, Nigerian currency was tired to both to the pound and dollar. Almost throughout the 1970s there was persistent appreciation of the nominal exchange rate of the naira occasioned by increases in the price of oil in the international market. These appreciations in the nominal exchange rates gave rise to over-reliance on imports with its accompanying capital flight, discouraging non-oil exports which ultimately led to Balance of Payments problems and depletion of external reserves. The increase in the marginal propensity to import, according to Osaka, Mashe, and Adamgbe (2003), the agricultural sector in Nigeria collapsed. In 1978, the naira was pegged to a basket of 12 currencies comprising Nigeria's major trading partners. However, the 1978 policy was jettisoned in 1985 in favour of quoting the naira against the dollar.

Before 1986, the prevailing exchange rate policies encouraged over-valuation of the naira. To solve the problems associated with the over-valuation the naira was deregulated in September 1986 under the Structural Adjustment Programme Package. To enhance the implementation of the Structural Adjustment Programme was the introduction of the Second-tier Foreign Exchange Market (SFEM). SFEM was expected to usher in a mechanism for exchange rates determination and allocation in order to ensure short term stability and long term Balance of Payments equilibrium.

As stated by Mordi (2006) the essential objectives of SFEM include to achieve a realistic naira exchange rate through the market forces of demand and supply, more efficient allocation of resources, stimulation of non-oil efforts, encourage foreign exchange in flow and discourage outflow, eliminate currency trafficking by wiping out unofficial parallel foreign exchange market, and lead to improvements in the Balance of Payments.

Several modifications were made in order to achieve the objectives of SFEM, from Foreign Exchange Market (FEM) to Autonomous Foreign Exchange Market (AFEM), to Dutch Action System and, to the wholesale Dutch Auction System. The FEM was introduced as a result of the problem arising from the first and second tier market rates in July 1987. Bureau de change was introduced in 1989 with a view to enlarging the scope of FEM. In 1994, the fixed exchange rate system was reintroduced. In 1995 there was a policy reversal of guided deregulation referred to as the Autonomous Foreign Exchange Market (AFEM). In 1999 was the reintroduction of the inter-bank foreign exchange market (IFEM). This brought about the merger of the dual exchange rate, following the abolition of the official exchange rate from January 1, 1999. In 2002 was the re-introduction of the Dutch Auction System (DAS) as a result of the intensification of the demand pressure in the foreign exchange market and the persistence in the depletion of the country's external reserves. Finally, was the introduction of wholesale DAS in 2006, which further liberalized the market in an attempt to evolve a realistic exchange rate of the naira. Up till now, exchange rate regime in Nigeria is characterized as oscillating between fully managed and freely floating regimes.

3. Theoretical Literature

Exchange rate can be defined in different contexts, but the underlying element is that it is the price of one currency in terms of another. Thus, it measures the worth of a domestic economy in terms of another, especially in relation to trading partners' economies. Hence, the choice of an appropriate exchange rate policy is a crucial component of macroeconomic policy in a country (Jhingan, 2011). As stated by Obadan (2006), exchange rate is one of the most important macroeconomic variables necessary for the conduct of general economic policy making. Apart from connecting the price systems in different countries and enabling businessmen to compare prices directly, they are important in promoting exports and discouraging imports, thereby achieving healthy Balance of Payments Position.

Prior to the monetary – approach emphasis of the 1970s, it was common to emphasize international trade flows as primary determinants of exchange rates. Some of the recent advances in exchange rate theory are as follows:

i. The Portfolio Balance Theory: This theory developed by Branson et al (1975), assumes that residents distribute their wealth among three forms of assets – monetary base, domestic bonds, and foreign bonds. Exchange rate is in equilibrium when the holding of these assets are in their desired proportion. In portfolio analysis, the current account balance becomes the reflection of the government budgetary imbalance when the private sector is satisfied with the holding of financial assets. The inability of government to sell bonds to foreigners without an excessive fall in their prices reflected in the overall balance of payment deficit.

ii. The Purchasing Power Parity (PPP) Theory: According to Jhingan (2011), this theory states that equilibrium exchange rate between two inconvertible paper currencies is determined by the equality of the relative change in the price levels in the two countries. International competitiveness is measured by comparing the relative prices of the good from different countries when these are measured in a common currency. The Purchasing Power Parity Path for the nominal exhcnage rate is the path that would keep competitiveness constant overtime. According to this theory, countries with higher domestic inflation than their competitors would face a depreciating nominal exchange rate, while countries with lower domestic inflation than their competitors would face appreciating exchange rates.

iii. The Balance of Payments Theory: As demonstrated by Jhingan (2011), under a free exchange rate regime, a country's exchange rate depends upon its Balance of Payments. A favorable Balance of Payments raises the exchange rates, while an unfavorable balance of payments reduces the exchange rate. By implication, exchange rate is determined by the demand and supply of foreign exchange. According to this theory, adjustments in the balance of payments can be made through devaluations and revaluations of some currencies in the case of deficits and surpluses, respectively, in the balance of payments.

Mckinnon and Schnabl (2003) have argued that for small Open East Asian economies, fluctuations of the Japanese Yen against the U.S. dollar strongly affected the growth performance of the whole region. They identified trade with Japan as a crucial transmission channel.

Before 1965, the appreciation of the Japanese Yen against the U.S dollar enhanced the competitiveness of the smaller East Asian economies who kept the exchange rate in the region accelerated. The strong depreciation of the Yen against the dollar from 1965 into 1967 slowed growth, contributing to the 1997/98 Asian crisis.

Empirical Literature

In their study of exchange rate movements in Nigeria for the sample period 1986 to 2010, Eme and Johnson (2010), examined the possible direct and indirect relationships between exchange rate and GDP growth, using a simultaneous equation model within a fully specified (but small) macroeconomic model, coupled with a generalized method of moment (GMM) technique. The empirical results suggest that there is no evidence of strong direct relationship between changes in exchange rate and output growth. Rather they concluded that Nigeria's economic growth had been directly affected by monetary variables and that improvements in exchange rate management were necessary but not sufficient to revive Nigerian economy.

Magda (2004), examined the effect of exchange rate fluctuations to real output growth and price inflation in a sample of 22 developing countries. By introducing a theoretical rational expectation model he decomposed movements in exchange rate into anticipated and unanticipated components. The model demonstrated the effects of demand and supply channels on the output and price responses to changes in exchange rate. In general, he concluded that exchange rate depreciation; both anticipated and unanticipated decreases real output growth and increase price inflation. The result confirms concerns about the negative effects of currency depreciation on economic performance in developing countries.

Using different measures of real exchange rate and different estimation techniques, Dani (2008) showed that devaluation (high exchange rate) stimulates economic growth, particularly in developing countries, while revaluation hurts economic growth. Employing the same methods, Gala (2007) arrived at similar conclusion with Dani.

Kamin and Rogers (2000) conducted a study using quarterly data and several VAR models with four main variables, namely, exchange rate, output, price index, and US interest rate for the period 1981 to 1995 and showed that although the variation of output is explained mostly by its own innovations, a depreciation shock leads to a sustained reduction in output.

Odusola and Akinlo (2001) used a six-variable VAR model consisting of official exchange rate, parallel exchange rate, prices, money supply, and interest rate for Nigeria and revealed the existence of mixed results regarding the impact of exchange rate depreciation on output. His conclusion is that the contractionary impact of depreciation on output can only be represented in the first quarter, after which depreciation generates expansionary impact on output.

Berument and Pasogulleri (2003), estimated several VAR models for Turkey and found that real exchange rate movements are an important factor in the variability of output and inflation. According to him, the response of output is negative and permanent after a real devaluation and also inflationary.

In panel estimation for more than 180 countries by Edwards and Levy-Ye Yati (2003), evidence was found that countries with more flexible exchange rates grow faster than countries with fixed exchange rate regimes. Eichengrean and Leblang (2003) in another panel study showed the existence of a strong negative relationship between exchange rate stability and economic growth for 12 countries over a period of 120 years. They finally concluded that the results of such estimations strongly depend on the time, people, and the sample.

4. Model Specification

Exchange rate policy in Nigeria, as observed by Sani (2006) has gone through many changes but spanning between two major regimes, namely, the fixed and flexible exchange rate regimes. The fixed exchange rate system was adopted between 1960 and 1986, while the flexible system has remained in use from 1986 till date however, with series of little modification. Considering 1986 as the break period when Nigeria transited from the fixed exchange rate regime to the flexible exchange rate system, under the introduction of the Structural Adjustment Programme (SAP). Applying the Chow-Test procedure, the following structural equations will be estimated and tested, using Ordinary Least Squares (OLS) technique: The variables M_2 and GEXP have been included in the regression as they have been shown to be proximate determinants of RGDP.

1970-1975 : $RGDP_t = \beta_o + \beta_1 EXR_t + \beta_2 M_{2t} + \beta_3 GEX_t + U_{1t}$ $n_1=16$

1986-2011 : $RGDP_t = \alpha_o + \alpha_1 EXR_t + \beta_2 M_{2t} + \beta_3 GEX_t + U_{2t}$ $n_2=26$

1970-2011 : $RGDP_t = \theta_o + \theta_1 EXR_t + \theta_2 M_{2t} + \theta_3 GEX_t + U_{3t}$ $n_3= 42$

Where:

$RGDP_t$ = Current level of gross domestic product (a proxy for national output)
EXR_t = Current exchange rate
M_{2t} = Current level of money supply
GEX_t = Current level of government expenditure
β_i, α_i, and θ_i = Parameters to be estimated and tested.
β_o, α_o, and θ_o = constants of the relationships to be estimated.
U_1, U_2, U_3 = stochastic error terms.

As demonstrated by Gujarati (2009), the regression 1970-2011, assumes that there is no difference between the time periods 1970-1985 and 1986-2011 such that $\beta_0=\infty_0$, $\beta_1=\infty_1$, $\beta_{2=}\infty_2$, and $\beta_3 = \infty_3$. Regressions 1975-1985 and 1986-2011 assume that the parameters in the two time periods are different. In other words, there intercepts and slope coefficients are different.

5. Data Analysis and Interpretation of Results

Table 1: Unit Root Tests

Variable	LEVEL			1^{ST} DIFFERENCE			REMARKS
	ADF Test Statistic	1% Critical Value	5% Critical Value	ADF Test Statistics	1% Critical Value	5% Critical Value	
RGDP	-0.255491	-4.2023	-3.5247	-6.857681	-4.2165	-3.5312	1(1)
EXR	-1.607735	-4.2023	-3.5247	-6.881221	-4.2165	-3.5312	1(1)
M_2	2.328062	-4.2023	-3.5247	-8.449437	-4.2165	-3.5312	1(1)
GEX	-3.896689	-4.2023	-3.5247	-9.517706	-4.2165	-3.5312	1(1)

As shown in Table 1 above, all the variables are random walk models and became stationary after first differencing. It was after the first differencing that the Augmented Dickey Fuller (ADF) statistic became greater in absolute terms than the 1% and 5% critical values.

Given the integration properties of the variables, that is, since the variables are integrated of the same order, there was need to test for co integration using Johansen maximum likelihood estimation technique to determine the existence and extent of equilibrium or long run stable relationship among the variables. The co integration test result is presented in table 2 below:

Table 2: Johansen Co-Integration Test Result

ENGEN VALUE	LIKELIHOOD RATIO	5% CRITICAL VALUE	1% CRITICAL VALUE	HYPOTHESIZED NO. OF CE (S)
0.847383	144.7090	62.99	70.05	None **
0.646120	80.79492	42.44	48.45	At Most 1**
0.528151	45.47579	25.32	30.45	At Most 2**
0.443689	19.93851	12.25	16.26	At Most 3**
*(**) denotes rejection of the hypothesis at 5% (1%) significance levels. LR test indicates 4 co integrating equations at 5% significance level				

Table 2 above shows that there are 4 co integrating equations at 5% significance level and we conclude that there exists long run equilibrium relationship between real gross domestic product (RGDP), exchange rate (EXR), money supply (M_2), and government expenditure (GEX).

Having established the existence of co integrating relationship among the variables we no longer run the risk of arriving at spurious estimates using the ordinary least squares technique. Below is the estimated long run relationship based on ordinary least squares.

$RGDP_t = 133519.4 + 2576.7EXR_t + 0.0265M_{2t} - 0.0037GEX_t$
SE = (17621.66) (420.4556) (0.006931) (0.010913)
T = (7.577001 (6.128296) (3.820459) (-0.337037)

$\bar{R}^2$ = 0.846205
F = 76.19601
D – W statistic = 0.288965

As shown above, all the variables, apart from government expenditure (GEX) are positively related to Real Gross Domestic Product (RGDP). Holding all other factors affecting RGDP constant, a 1% increase in exchange rate (EXR) will increase RGDP by about ₦2576.7 million and vice versa; if money supply increases by ₦1 million, real gross domestic product will increase by N26500 and vice versa. Also, an increase in government expenditure by ₦1m, real gross domestic product will fall by only N3700 and vice versa.

Evaluation of the Estimated Parameters

(i) The adjusted R-squared value of 0.846205 implies that about 85 percent of the changes in Nigeria's gross domestic product is influenced by changes in the explanatory variables. The model can be seen to have a considerably high explanatory power.
(ii) The student t-test was conducted at 5% significance level and at the relevant 38 degrees of freedom. Since the computed t-value of 6.128296 and 3.820459 for exchange rate and money supply, respectively, are greater in absolute terms than the critical value of 2.021, the implication is that they are highly significant determinants of Nigeria's economic growth performance. Unfortunately, the computed t-value of -0.337037 for government expenditure indicates that government expenditure, within the sample period was not a significant determinant of Nigeria's economic growth performance.
(iii) The computed F- statistic value of 76.19601 at the relevant degrees of freedom for the numerator and the dominator indicates that the joint influence of the explanatory variables on the dependent variable (economic growth) is highly significant.
(iv) Since with 42 observations and 3 explanatory variables, the computed Durbin-Watson value of 0.288965 is less than the lower Durbin-Watson value (dL) of 1.34. From tables at 5% level of significance, the conclusion is that there is the presence of positive autocorrelation among the residuals of the model.

The Chow Test

The Chow test is a test of structural stability of the parameters of the model. From the empirical results, we obtain the following information:

Unrestricted Residual Sum of Squares (RSS_{UR}) = 1.59 E+10) + (4.44 E +10)
Restricted Residual Sum of Squares (RSS_R) from the pooled regression=3.05+11.
With the above information, the F-statistic is computed using the formulae:

$$F = \frac{RSS_R - RSS_{UR}/k}{RSS_{UR}/n_1 + n_2 - 2k}$$

$$F = \frac{-1.43125 \times 10^{-10}}{1.773529412 \times 10^{-11}}$$
$$= -8.07$$

From the F-tables (Koutsoyiannis, 1977), the theoretical value of 2.61 for 5% level of significance at 3 and 38 degrees of freedom for the numerator and the denominator, respectively, is greater than the computed F* value of -8.07, that is, 2.61 > -8.07. This result supports the hypothesis that the relationship between exchange rate and economic growth performance has not undergone an structural changes over the sample period 1970 to 2011.

6. Summary, Conclusion, and Policy recommendation

This paper aimed at investigating the quantitative impact of foreign exchange polices in Nigeria: A test of stability of the parameter estimates. Exchange rate policy in Nigeria has undergone a good number of changes, from a fixed exchange regime in 1960, and a pegged regime between 1970s and mid 1980s and finally to various variants of the floating regime from 1986 with the deregulation and adoption of the Structural Adjustment Policy (SAP). The SAP policy, among other objectives, was aimed at evolving a realistic exchange rate for the naira.

From the empirical results, exchange rate, output (proxied by RGDP), and other variables examined were found to exhibit random walk processes and became stationary after first differencing. The co integration test conducted on the variables using Johansen's co integrating technique indicated that all the variables are co integrated at both 1% and 5% levels of significance. The estimated long run equation, using OLS technique indicated that exchange rate (EXR) and broad money supply (M_2) were highly significant determinants of economic growth performance in Nigeria. However, government expenditure (GEX) included in the model did not show up as a significant determinant. The Adjusted R-squared value of about 0.85 was considerably high. It implies that about 85% of the changes in Nigeria's economic growth performance is influenced by the model. The F-value of 76.19601 used in testing the joint influence of the explanatory variables on the dependent variable was shown to be highly significant. The Durbin-Watson value of 0.288965 indicated the presence of autocorrelation of the first order among the residuals of the model. This implies that any shock arising from exchange rate or any of the explanatory variables do not disappear instantaneously but extends into the next periods. The Chow test conducted to test the structural stability of the regressors supports the hypothesis that the relationship between exchange rate and economic growth performance in Nigeria has not undergone any structural changes.

The implication of these results is that exchange rate has always been a crucial factor in the determination of Nigeria's economic growth performance; that whatever may be the adopted regime, whether fixed or flexible, the important thing is effective management in order to yield the desired results.

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