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By Tamunonimim A. Ngerebo-a & Reginald C. Ibe
Rivers State University of Science and Technology, Nigeria

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Exchange Rate and Macroeconomic Performance in Nigeria: A Causal Post Structural Adjustment Programme Investigation

Tamunonimim A. Ngerebo-a [α] & Reginald C. Ibe [σ]

Abstract- This paper investigates the causal relationship between exchange rate, balance of payment, external debt, external reserves, gross domestic product growth rate and inflation rate in Nigeria post Structural Adjustment Programme (SAP). Annual time series data 1987-2011 were used as the research sample period. The data were sourced from CBN Statistical Bulletin and Annual Reports of various years. We applied the ADF and PP unit root tests to check the stationarity of the variables. Gross domestic product growth rate and external reserve were stationary at both levels I (0) and I (1). The Johansen cointegration test, equation estimation and Granger causality tests were applied. Johansen cointegration result shows that there exists a long-run equilibrium relationship among the indicators. The Granger causality test between the dependent and independent variables shows a unidirectional causality from exchange rate to BOP, external reserves and gross domestic product growth rate. The independent variables indicate a unidirectional causality from gross domestic product growth rate to external reserve. On the whole this paper has provided empirical evidence that there is a causal relationship between exchange rate and some macroeconomic indicators in Nigeria post SAP. These indicators however impact on the determination of exchange rate in Nigeria. Certain policy implications arise from this finding. It demonstrates the need for monetary authorities to learn from past exchange rate management and come up with a monetary policy framework that complimes the existing exchange rate policy and ensures stability.

Keywords: Exchange Rate, Macroeconomic Indicators, Cointegration.

I. Introdcution

Exchange rate is the ratio between a unit of one currency and the amount of another currency for which that unit can be exchanged at a particular time. Exchange rate plays a vital role in a country's level of trade, which is critical for every free market economy in the world. It is therefore not surprising that, exchange rate is among the most watched, analyzed and government manipulated macroeconomic indicator. Most countries attempt to moderate their domestic currency fluctuations by imposing restrictions on exchange rate movements (Benita and Lauterbach, 2007). It is a key macroeconomic measure in the context of general economic reform programmes and because of its importance government takes active part in its determination. Specifically, it is important as the connection between the price systems of countries, as price in the allocation of real resources among tradable and non-tradable sectors, as a promoter or otherwise of imports and exports, and as an instrument in the design of the balance of payment programme of countries.

Economic history has shown that there are two common concepts of exchange rate namely nominal exchange rate and real exchange rate. The nominal exchange rate (NER) is a monetary concept which measures the relative price of two countries' moneys or currencies, e.g., naira in relation to the U.S. dollar (e.g., N1 28.00: US$ 1.00) and vice verse. The monetary concept informs on how much the price level of international goods has risen/fallen relative to domestic prices as a result of changes in the exchange rate. Real exchange rate (RER), on the other hand, is the concept that measures the relative price of two goods – tradable goods (exports and imports) in relation to non-tradable goods (goods and services produced and consumed locally). There is a link between the two concepts in that changes in the NER can cause short-run changes in the RER. For example, a NER devaluation (depreciation will have the effect of depreciating the RER). It is important to note that since the introduction of the Second Tier Foreign Exchange Market (SFEM) under SAP in Nigeria in 1986, the first definition of exchange rate has been most pronouncedly used.

Analysis of Nigeria's exchange rate movement from 1970-2005 showed that there exists a causal relationship between the exchange rate movements and some macroeconomic indicators, though not directional. Consequently, it has been contensious to conclude that the depreciation in exchange rate predicts changes in other macroeconomic variables such as inflation, GDP growth, and fiscal deficit/GDP ratio, and vice versa.

This paper attempts to improve on existing literature by investigating empirically (1) the relationship between some macroeconomic indicators and exchange rate in Nigeria post-SAP by estimating a model that would help explain the short and long-run behavior of exchange rate vis-a-vis movements in the

Author α: Department of Banking and Finance, Faculty of Management Sciences, Rivers State University of Science and Technology, P. M. B. 5080, Nkpolu, Port Harcourt, Rivers State, Nigeria. e-mail: oniminp2002@yahoo.com

Author σ: Department of Finance and Banking, Faculty of Management Sciences, University of Port Harcourt, Choba, Port Harcourt

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mentioned indicators, and (2) if a causal relationship exists between exchange rate andthe indicators.

II. Theoretical Framework

a) Exchange Rate Management Before 1986

Exchange rate policy in Nigeria has undergone substantial transformation since post-independence era when the country operated a fixed exchange rate system up to the early 1970s and then from 1986 when a market-based exchange rate system was introduced in the context of the Structural Adjustment Programme (SAP). Before 1973, Nigeria's exchange rate policy was in consonance with the IMF par value or fixed exchange system. The Nigerian currency had its exchange rate largely subjected to administrative management because it was not a traded currency. The exchange rate was dictated by the fortunes or otherwise of the British Pound Sterling up to 1967 when the pound was devalued and thereafter to the dollar. The naira was adjusted in relation to the dollar following the breakdown of the IMF par value system in December of 1971. In 1978, the naira was pegged to a basket of 12 currencies comprising Nigeria's major trading partners. This policy was abolished in 1985 in favour of quoting the naira against the dollar. The main objectives of exchange rate policy during this period were to: (a) equilibrate the balance of payments; (b) preserve the value of external reserves; and (c) maintain a stable exchange rate. Although, a number of ad-hoc measures were adopted to realize the policy objectives, it can be said that economic objectives played a major role in determining the exchange rate. Thus, throughout the 1970s, except 1976 and 1977, the nominal exchange rate appreciated every year. The policy encouraged heavy reliance on imports which ultimately led to balance of payments problems and depletion of external reserves. Nevertheless, up to the time of SAP, exchange rate policy encouraged the overvaluation of the naira as reflected in real exchange rate appreciation, particularly in the 1970s (Obadan, 1993b, 1994 and 1995). A major factor in the real exchange rate appreciation was the sharp increase in oil prices and foreign exchange inflows. The exchange rate generally mirrored movements in oil prices. The real appreciation of the exchange rate encouraged imports and capital flight, discouraged non-oil exports and helped to sustain the manufacturing sector's over dependence on imported inputs. The agricultural sector was seriously undermined. Annual production of major cash crops (cocoa, rubber, cotton, and groundnut) fell by 42, 29, 65 and 64 per cent, respectively, between 1970 and 1985 (Osaka, Masha, Adamgbe, 2003: 329).

b) Exchange Rate Management Post SAP

This can be examined from the perspective of exchange rate policy objectives, strategies and frameworks, movements and their effects. The core objectives of the adjustment and reform programme include the adoption of a realistic foreign exchange rate policy, stimulation of domestic production and broadening of the supply base of the economy, improved trade and payment liberalization and privatization of public sector enterprises among others (Soludo, 1993: 51). Under SAP, the exchange rate strategy was to float the naira and establish an institutional framework for its trading in a market-determined environment. SFEM was expected to evolve an effective mechanism for exchange rate determination and allocation of foreign exchange in order to guarantee short-term stability and long-term balance of payments equilibrium. SFEM began as a dual exchange rate system which produced the official first-tier exchange rate and the SFEM or market determined exchange rate.

The essence of the dual exchange rate system was to avoid a deliberate uniform and sizeable depreciation of the naira but to allow it to depreciate in the SFEM while at the same time the monetary authorities would continue a downward adjustment of the first-tier rate until the two rates converge to produce a realistic exchange rate. This convergence was achieved on July 2nd, 1987 at the rate of N3.74: $1.00. But some analysts described it as forced (Ojameruaye, 1991). Essentially, the objectives of SFEM include the following: achievement of a realistic exchange rate determined by the market forces; more efficient resource allocation through the substantial reduction of fraudulent and wasteful transactions; stimulation of non-oil exports; encouragement of foreign exchange inflows and discouragement of outflows; enhanced revenue for government; redressing of the gross imbalances in rural-urban incomes and welfare; and elimination of currency trafficking and wiping out of unofficial parallel foreign exchange market. Thus, the ultimate expectation was that the exchange rate policy and management actions would lead to an improvement in the BOP position and ensure large degree of convertibility of the naira.

III. Methodology

a) Research Design

Our econometric model is with emphasis on six macroeconomic indicators, using ordinary least squares. Our choice of the OLS approach is premised on the Gauss-Markov theorem which postulates that the least squares technique is the best linear unbiased estimator (BLUE), with which straight line trend equations could be estimated. The sample consists of 25 annual data from 1987 to 2011 obtained from CBN Statistical Bulletin of 2013 and Annual reports of various issues.

b) Model Specification

The functional form on which our econometric model is based is:

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EXCHR = f(BOP, EXTDB, EXTRE, GDPGR, INFLR)

$$EXCHR_t = \beta_0 + \beta_1 BOP_t + \beta_2 EXTDB_t + \beta_3 EXTRE_t + \beta_4 GDPGR_t + \beta_5 INFLR_t + U_t \quad \text{Eq. 1}$$

The following is the logarithm form of the above equation aimed at achieving stationarity of the data (Hydroyannis and Papapetrou, 2001; Maysami et al., 2004).

$$\ln EXCHR_t = \beta_0 + \ln\beta_1 BOP_t + \ln\beta_2 EXTDB_t + \ln\beta_3 EXTRE_t + \ln\beta_4 GDPGR_t + \ln\beta_5 INFLR_t + U_t \quad \text{Eq. 2}$$

The following are a priori expectations of the coefficients of the model

β1, β3, β4 > 0; β2, β5 < 0

Where:

EXCHR = Exchange rate is annual exchange rate (naira/US dollar) valued in rate and the dependent variable.

BOP = Balance of payment represents the annual balance of payment as a percentage of gross domestic product.

EXTDB = External debt represents annual external debt as a percentage of gross domestic product in per cent.

EXTRE = External reserves represents annual external reserves as a percentage of gross domestic product in per cent.

GDPGR = Gross domestic product growth in percentage

INFLR = Inflation rate represents annual inflation rate in percent.

Ln = natural logarithmic notation

β_0 = Slope coefficient

$\beta_1, \beta_2, \beta_3, \beta_4, \beta_5$ = Coefficient of the parameters

U = Error or stochastic term

IV. Presentation of Results and Analyses

Table 1 : Unit Root Test Results

Variables	ADF T-STATS	PP T-STATS	STATUS
LOGEXCHR	-4.640537	-4.640862	
1%	-3.752946	-3.752946	
5%	-2.998064	-2.998064	I (1)
LOGBOP	-5.562671	-14.00106	
1%	-3.769597	-3.752946	
5%	-3.004861	-2.998064	I (1)
LOGEXTDB	-3.384258	-3.355161	
1%	-3.752946	-3.752946	
5%	-2.998064	-2.998064	I (1)
LOGEXTRE	-5.698587	-9.179070	
1%	-3.769597	-3.752946	
5%	-3.004861	-2.998064	I (1)
LOGGDPGR	-5.602115	-17.21477	
1%	-3.788030	-3.769597	
5%	-3.012363	-3.004861	I (1)
LOGINFLR	-7.216071	-11.04521	
1%	-3.752946	-3.752946	
5%	-2.998064	-2.998064	I (1)

Source: Authors compilation from Eviews 7.0 printout

To guard against spurious result arising from non-stationarity behavior from level form, this study cautiously checked the properties of the variables used in the model via the Augmented Dickey Fuller (ADF) test and the Philip-Perron (PP) test. As observed from both ADF and PP test results in table 4.1, all the estimating variables were stationary at their first difference. However, gross domestic product growth rate (GDPGR) and inflation rate (INFLR) were stationary at both level and first difference. Therefore, the null hypothesis of non- stationarity was rejected in all the series. Following our results, all the variables were used in the model at their first differences.

a) Johansen and Juselius Multivariate Cointegration Test

Given the default with the Engel and Granger (1987) cointegration test, this study adopted the Johansen and Juselius (1990) multivariate cointegration technique.

There are two test statistics for cointegration under the Johansen approach and they are formulated as:

$$\lambda_{(trace)}(r) = -T \sum_{i=r+1}^{k} \ln(1 - \lambda i)$$

and

$$\lambda_{max}(r, r+1) = -T \ln(1 - \lambda_{r+1})$$

where r is the number of cointegrating vectors under the null hypothesis and λ_i is the estimated value for the ith ordered eigenvalue from the Π matrix. Intuitively, the larger is λ_i, the larger and more negative will ln(1- λ_i) be and hence the larger will be the test statistic.

λ_{trace} is a joint test where the null is that the number of cointegrating vectors is less than or equal to *r*.

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λ_{max} conducts separate tests on each eigenvalue, and has its null hypothesis that the number of cointegrating vectors is *r* against an alternative of *r* + 1. Where the eigenvalue statistics results of Trace and Maximum differ, the result of the Trace should br preferred (Alexander, 2001).

Table 2 : Johansen Test for Cointegration Result

HYPOTHESIS	TRACE STATISTIC λ_{trace}	CRITICAL VALUES (95%)	MAX EIGENVALUE STATISTIC	CRITICAL VALUES (95%)
r≤ r = 0	199.5669 (0.0000)	95.75366	90.86176 (0.oooo0	40.07757
r ≤ r >1	108.7051 (0.0000)	69.81889	50.92612 (0.0000)	33.87687
r ≤ r > 2	57.77899 (0.0045)	47.85613	28.21174 (0.0415)	27.58434
r ≤ r > 3			22.09206 (0.0366)	21.13162

Note: Number of Cointegrating vectors: 3. Figures in parenthesis are probability Values (MacKinnon-Haug Michelis, 1999 p-values.

Source: Authors compilation from Eviews 7 result

The Johansen cointegration test result is presented in table 4.2. The trace statistic either rejects or does not reject the null hypothesis of no cointegration among the variables. If Trace statistic > the critical value, then reject Ho and accpt H1 (there are r+1 cointegration vectors), where H0: r=0, 1, 2, …g; and the test conducted sequentially until the H0 is no longer rejected (Brookss, 2008:352). In our test H0: r=0, H0: r=1 and H0: r=2 are rejected at the 5% level of significance hence we find that our variables are not cointegrated. The final number of cointegrating equation with two lags is three. This result indicates that there exists a long run equilibrium relationship between exchange rate, balance of payments, external debt, external reserves, gross domestic product growth rate and inflation rate in Nigeria post SAP.

Table 3 : Equation Estimation result

Dependent Variable: LOGEXCHR
Method: Least Squares
Date: 09/18/13 Time: 18:13
Sample (adjusted): 1989 2011
Included observations: 23 after adjustments

Variable	Coefficient	Std. Error	t-Statistic	Prob.
C	0.180253	0.356592	0.505488	0.6232
LOGBOP	0.043038	0.030819	1.396490	0.1901
LOGEXTDB	0.324027	0.095645	3.387816	0.0061
LOGEXTRE	0.028418	0.093652	0.303445	0.7672
LOGGDPGR	-0.047854	0.032018	-1.494606	0.1631
LOGINFLR	-0.115135	0.039380	-2.923709	0.0138
LOGEXCHR(-1)	0.708263	0.097918	7.233243	0.0000
LOGBOP(-1)	0.083903	0.031084	2.699238	0.0207
LOGEXTDB(-1)	-0.160066	0.085211	-1.878481	0.0871
LOGEXTRE(-1)	0.096676	0.079578	1.214863	0.2499
LOGGDPGR(-1)	-0.048882	0.033213	-1.471751	0.1691
LOGINFLR(-1)	0.023142	0.037962	0.609609	0.5545

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R-squared	0.988448	Mean dependent var	3.941071
Adjusted R-squared	0.976897	S.D. dependent var	1.091755
S.E. of regression	0.165944	Akaike info criterion	-0.448457
Sum squared resid	0.302911	Schwarz criterion	0.143975
Log likelihood	17.15725	Hannan-Quinn criter.	-0.299462
F-statistic	85.56834	Durbin-Watson stat	2.075212
Prob(F-statistic)	0.000000		

Source: Eviews 7 printout.

The result of our equation estimation after adjustment is presented in table 4.3. This result can also be used in determining the short-run relationship amongst the variables (Brooks, 2008: 43).Based on this result, the overall performance of the model after adjustment has a good fit. Both the R-squared (98.8 percent) and the adjusted R-squared (97.6 percent) were very much above average. The adjusted R-squared valuesuggests that the independent variables were able to explain 97.6 per cent of the variation in exchange rate (dependent variable). The Durbin-Watson statistics (2.075212) is a little higher than the traditional benchmark of 2.0 in the model so we don't have to worry about serial correlation problem. The F-stat (F-stat 85.56834, p=0.00000) of the model is statistically highly significant suggesting that, collectively, all the variables have a significant impact on exchange rate. Inflation rate (INFLR), external reserves (EXTRE), balance of payment (BOP) had their expected signs while gross domestic product growth (GDPGR) and external debt (EXTDB) had negative and positive signs respectively contrary to their a priori expectation.

Also the coefficients of the independent variables were examined to determine the nature of their relationship with the dependent variable (Exchange rate). The coefficient of inflation rate is negative (-0.115135) and significant (p=0.0138) in the short run. The coefficient of gross domestic product growth rate (-0.047854) is negative and insignificant (p= 0.1631) in the short run. External debt (EXTDB) is positive (0.324027) and significant (p=0.0061) in the short run. External reserves (EXTRE) is positive (0.028418) and insignificant (p=0.7672) in the short run while balance of payment (BOP) is positive (0.043038) and insignificant (p=0.1901) in the short run also. The insignificant relationship between exchange rate, balance of payment, gross domestic product growth rate, and external reserve could be as a result of the length of time (long run) it takes for changes in these independent variables to reflect on the overall domestic economy.

b) Granger Causality Test

Given the basis and the use of granger causality tests in the determination or classification of the variables into independent and dependent, based on the direction of flow of influence (Order & Fisher, 1993; Marin, 1992; McCarville and Nnadozie, 1995; Darat, 1996; and Pomponio, 1996), as well as the result of the Pairwise Granger test as presented in Table 4.4, we reject the null hypothesis if the probability value is more than 5% otherwise we do not reject the null hypothesis if the probability value is less than 5%.

Table 4 : Pairwise Granger Causality test Result

	F-STAT	PROB
EXCHR→ BOP	8.11944	0.0096
EXCHR → EXTRE	7.73896	0.0112
EXCHR → GDPGR	5.94805	0.0242
EXTRE → BOP	8.41714	0.0085
BOP → EXTRE	4.66701	0.0425
GDPGR → EXTRE	6.06991	0.0229

Source: Authors compilation from Eviews 7 output

The Granger causality test between the variables suggests a unidirectional causality from exchange rate to balance of payments, external reserves and gross domestic product growth rate. This shows that there is a causal relationship between the variables. Exchange rate follows its counterparts in the short run and there exists a lead-lag relationship between them. The causality test between the independent variables indicates bidirectional causality between external reserves and balance of payments implying that past values of both variables have predictive ability in determining their present values. A unidirectional causality between gross domestic product growth rate and external reserves implies that gross domestic product growth rate has a predictive ability on the present value of external reserves.

V. Conclusion

It can be concluded that there is a causal relationship between exchange rate, balance of payment, external debt, external reserves, gross domestic product growth rate and inflation in Nigeria post-SAP. These indicators somehow impact exchange rate determination in Nigeria post-SAP. Constant changes in exchange rate framework, rather than foster a better market efficiency, has only succeeded in creating instability in the markets. The parallel foreign exchange market has not been eliminated. The poor exchange rate performance may not be unconnected with the unfulfilled expectations concerning the role of market mechanism in determining exchange rate in our type of environment, coupled with the absence of complimentary policies, e.g. monetary, fiscal and investment policies.

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VI. Recommendation

Certain policy implications arise from the findings. It demonstrates the need for a monetary policy framework that compliments the existing exchange rate policy. On the whole, this paper has provided empirical evidence of the relationship between exchange rate, balance of payment, external debt, external reserves, gross domestic product growth rate and inflation rate in Nigeria post SAP. The results suggest a causal and significant relationship between the variables. The Johansen cointegration result demonstrates that exchange rate and these variables are cointegrated. Given this, it is important for monetary authorities to learn from past exchange rate management in order to improve on the existing framework and ensure exchange rate stability in Nigeria. It is desirable to monitor the movements in the rates so as to foster competitiveness and improve the supply of our exports.

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