Innovations

Exchange Rates and Macroeconomic Fundamentals in a Small Commodity-Export-Dependent Economy

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Abstract

Problem*: The relationship between exchange rates and macroeconomic fundamentals has long been debated to be unclear especially when viewed from different schools of thoughts. Hence this study focused on exploring the relationship existing between of exchange rates and macroeconomic fundamentals in Nigeria.* ***Design/Methodology/Approach****: Series of Real exchange rate and Macroeconomic fundamentals were employed to the Vector Error Correction Mechanism (VECM) ,and cointegration technique in order to evaluate the response of the performance of the Nigerian national economic and wealth creating activities to currency depreciations.* ***Findings:*** *Our results indicate that about 1 per cent depreciation of the real exchange rate accounted for about 0.90 per cent decline in the performance of the national economic and wealth creating activities in both short and long-run. This depicts the existence of a contractionary policy effect.* ***Conclusion:*** *The long-run contractionary effect of real depreciations may not be appealing for considering exchange rate policy as a development strategy, the likelihood of the contribution of the capital account component of the BOP must be reckoned as it has a significant effect on growth in the long run, implying that relevant macroeconomic fundamentals must be targeted in improving the output of productivity as there seems to exist a strong link between the capital account component, exchange rate and other macroeconomic fundamentals which culminates into growth. Therefore, government and her agencies especially the monetary authorities should ensure that exchange rates and fundamentals including the capital account component of the BOP are well managed for growth-enervating purposes.*

Keywords:*1. Exchange Rate, 2.Economic Growth, 3. Macroeconomic Fundamentals, 4. Nigeria*
JEL Classification: Q24, O42, H5, F66, F13

1. Introduction

Globally, economies interact with each other through the platform of international trade. These inter-economic relations that use trade of goods and services as a channel has been predicated on a suitable and widely acceptable medium of payments for the goods and services exchanged. This medium of payment is lubricated by the exchange rate. The exchange rates (henceforth EXCRs) have played very important role in facilitating and sustaining this trade relations. For the domestic currency that is exchanged for a non-domestic currency to function effectively, it must interact with some essential economic fundamentals (such as capital account, credit to the private sector, government consumption expenditure, interest rates, inflation , etc.).

The empirical justification of the supposed relationship existing between the economic fundamentals and exchange rates has been the major issue of contention over the years. Studies such as Frenkel (1976, 1979), Mussa (1976) and Bilson (1978a, 1978b). Dornbusch (1976), Frankel (1979). Sarantis (1994); Cushman (2000) ; and Engel and West (2005) have studied this relationship using the monetary model. However, it was observed that, the idea gleaned from these studies, the theoretical definition and description of the economic fundamentals are somewhat restricted to only money supplies, real outputs and inflation rate. But there are arguments that the relationship between these economic fundamentals and real exchange rates transcends the monetary description adopted by the studies cited above; as it extends the components of economic fundamentals to other variedly defined monetarists' fundamentals. Some studies including Achsani *et al.*,(2010); Devereux and Lane (2003), and Arize, Osang and Slottje (2000) concluded that, it was within the ambit of this combination that EXCRs either facilitates or hinders economic growth. Worthy of note is the conclusion reached by Ocampo (2019) that these

thematic issues pin-pointed the essential qualities of exchange rate policies in consonance with monetary and fiscal policies, but not without the specific and seemingly contradictory connections existing between monetary policies and EXCRs in recently emerging economies subject to 'strong boom and bust cycles' associated with external financing (Ocampo,2019).Furthermore, it is within the ambit of this premise that EXCRs can manage both pro-cyclical and counter-cyclical macroeconomic policies emanating from the adoption of such fundamentals (Frenkel and Rapetti,2014).

However, Ocampo (2019) affirmed that, in commodity-export-dependent economies (including Nigeria) ,capital flows almost always reinforce rather than curtailing the commodity-price cycle; and concluded that overwhelming evidences abound that capital flows to commodity-export-dependent economies are pro-cyclical (a principal determinant of business cycles).

Therefore, the principal objective/ aim of this paper is to revisit the nature and type of relationship existing among exchange rate, macroeconomic fundamentals and growth of productive economic activities in the Nigerian national economic and wealth creating activities.

2. Empirical Review

Salman and IIker (2012) examined the effects of nominal effective exchange rate (NEER) changes on selected macroeconomic fundamental (trade balance) in Malawi. The study applied multivariate cointegration test and their results indicate that, in the long-run exchange rate devaluation has insignificant impact on trade balance. Furthermore, the result of the study showed that using trade balance has significant impact on domestic income changes in Malawi .

Anning , Riti and Yapatake (2015) investigated the relationship between exchange rate and trade balance in Ghana from 1980 to 2013 by testing the validity of the Marshall-Lerner condition. The study applied the cointegration and vector error correction model (VECM) estimation techniques. The empirical results revealed that real effective exchange rate has negative relationship with the macroeconomic fundamental-trade balance in the long-run. But in the short-run, the results showed that exchange rate has positive relationship with trade balance. Therefore, the study concluded that exchange rate depreciation does not improves Ghana's trade balance in the long-run (because the Marshall-Lerner condition was not satisfied : since the coefficient was less than unity); however, the evidence from the result indicated that exchange rate depreciation can be used to improve on the performance of trade balance (Lal and Lowinger,2002).

Rodrik (2013) noted that EXCRs can be adopted in the management of cyclical swings associated with capital flows and its importance in curtailing the overwhelming effects of counter-cyclical macroeconomic policies for long-term growth. The study pinpointed the essential problem that comes with capital flows. It is worth noting that, capital flows like finance, are generally exchange-rates-pro-cyclical and can be complemented with suitable macroeconomic fundamentals as the only means of combining them with counter-cyclical outcomes (Rodrik, 2008, 2007 and 1994).

2.2 Theoretical Review

Variants of Real Exchange Rate

There are basically two variants of the real exchange rate. The traditional variant known as purchasing power parity real exchange rate often defined as the comparison of the domestic price of a representative basket of goods and services with an equivalent foreign price converted into the value of the local currency (a measure of generalised competitiveness); and the other but more recent variant that compares the prices of non-tradable in domestic economy with the prices of tradables of the rest of the World. The non-tradables are represented by GDP deflator: a proxy for services and labour while tradables are represented by either the import and export prices of the domestic economy or wholesale prices of the rest of the World . The main advantage of the second variant of the real exchange rate is that for a small commodity-export-dependent national economic and wealth creating activities that can hardly influence the international prices of tradable goods, it provides a measure of the changing incentives to enter or exit either the consumption or production of non-tradable and tradable goods.

Proxy and Terms Describing Real Exchange Rate

The proxy, term or definition of exchange rate used by the different studies differ. Some of the studies used the term, real effective exchange rates (REER), exchange rate misalignment, real exchange rate (RER) exchange rate

uncertainty, real exchange rate changes and exchange rate disequilibrium amongst others. The most commonly used term in the literature are highlighted below.

Exchange rate misalignment has been frequently used in the literature to refer to the deviation of the real exchange rate from its original or initial equilibrium value and position. Exchange rate misalignment has been described as the large and prolonged departures from the fundamental equilibrium exchange rate (Ocampo,2015). These deviations can occur in the form of undervaluation and overvaluations. Relatively large undervaluation can cause unpleasant and undesirable consequences for foreign debts, financial solvency and, prices of imports and exports. Similarly, large overvaluations can result into mounting-up of external debts and undermine trade competitiveness

(Tarawalie, 2010; Ocampo, 2008).

Currency overvaluation refers to a situation whereby the purchasing power of the currency in terms of foreign goods and services is higher than its domestic purchasing power (in purchasing domestic goods).This means that a unit of the local currency can buy more of goods produced abroad than those produced at home. Overvaluation is almost always caused by expansionary monetary and fiscal policies, terms of trade shocks , survival of a formidable shadow currency market and prolonged inflationary pressures (Elbadawi and Kaltani, 2011).

On the other hand , currency undervaluation connotes that the domestic currency exchanges at a high rate for the non-domestic currency; that is, a unit of the domestic currency can buy a lesser quantity of imported commodities compared to the goods produced at home. This often result to current account and trade surplus; implying that, local consumption and investment become lower than desirable for the national economic and wealth creating activities to afford and real wages are usually weak compared to the external sector (Glüzmann *et al.* (2012; Rodrik, 2008).

3. Theoretical Framework

This study adopts the Rhodd (1993) simple three-market model in deriving the equations for our model specification and estimation. Three structural markets (good, monetary and foreign exchange) constitute the bedrock of the Rhodd model. The good market is represented as specified in equation(1) or (2):

$$Y_t = C_t + I_t + G_t + (X_t - M_t) \quad (1)$$

or

$$Y_t - C_t - G_t =_t I_t + X_t - M_t \quad (2)$$

In either equation (1) or (2), Y_t represents total expenditure, C_t represents consumption expenditure, I_t represents domestic investment expenditure, S represents savings, G_t represents government expenditure and I_f represents net exports or foreign investment.

Our empirical model is based on equation (2) which captures the relationship between output (real), a measure of monetary policy , the exchange rate and public expenditure, which is included in the savings-investment identity.

Methodology

Data: Sources and Description

The annual data used for this empirical study were extracted from the World Bank World Development Indicators (WDI) for the period (1985-2021).

Our empirical model specification follows the analytical framework highlighted above. The theoretical model represents a long-run relationship between economic growth, real exchange rate (REXCH) : a measure of fiscal and monetary policies and other selected macroeconomic fundamentals variables. Using the logarithmic transformation of the variables, the empirical specification of the model can now be written as:

$$\ln GDP_{(growth)_t} = \lambda_0 + \lambda_1 \ln(GEXPD)_t + \lambda_2 \ln(PSC)_t + \lambda_3 \ln(TOT)_t + \lambda_4 \ln(REXCH)_t + \lambda_5 (CAP)_t + \varepsilon_t \quad (3)$$

where $GDP_{(growth)_t}$ $(GEXPD)_t$, $(PSC)_t$, $(TOT)_t$, $(REXCH)_t$ and $(CAP)_t$ are growth of GDP, government consumption expenditure, Banks credit to the private sector, real exchange rate and capital account. The error term is represented by ε_t. It is expected that λ_1 and λ_2 show positive relationship, whereas the sign of λ_3 cannot

be determined *a priori*. The coefficient of λ_4 which captures the effect of real exchange rate on output is one the primary interests of the current study but its sign cannot be concretely determined *a priori*. λ_5 represents the capital account component of the balance of payment, whose sign also cannot be predetermined *a priori.*

The Purchasing Parity Price (PPP) theory, posits that the performance of EXCRs are determined by the difference between domestic and foreign rates of inflation with the real exchange rate defined as the ratio of foreign prices (P_{ff}) to domestic prices (P_{dd}) adjusted for the nominal exchange rate (local currency per unit of foreign currency, E). Therefore, the operational definition of real exchange rate can thus be represented as;

$$Exchange_{real} = Exchange_{no\min al}\left[\frac{P_{ff}}{P_{dd}}\right] \qquad (4)$$

The computation of the real exchange rate in equation (15) would require the proxies of the two price indices as adopted by Harberger (1986) .

However, several empirical studies, such as Atkins (2000), Rhodd (1993) , and Edwards (1986) also include the respective country's external terms of trade (TOT) representing an important proxy for net exports (.

We adopted government expenditure as a measure of fiscal policy stance.

The use of total domestic credit could be justified as a proxy and measure of monetary policy because of its impact on income through domestic investment. One major problem, however, is that a part of domestic credit is also included in government expenditure. Therefore, to solve this problem, we adopt credit to the private sector as a proxy for monetary policy.

Estimation Technique

Unit Root Test

The Empirical estimation of our model begins by testing for the stationarity of the series using the Augmented Dickey and fuller [1979](ADF), the Phillip and Perron[1988] (PP) and the KPSS unit root tests. If the series are stationary without any differencing, it is designated as integrated of order zero, I(0) (Benita and Lauterbach, 2007). On the other hand, series that have stationary first difference are described as integrated of order one, I(1) (Sokolov *et* al.,, 2011; Ishioro, 2022a,2022c and 2022d).

Long-run Cointegration Test

Among several cointegration technique in the literature, the Johansen cointegration technique is preferred and adopted. This method makes room for the acceptance of more than one cointegrating equation. Johansen and Juselius (1990) procedure uses two tests (the Maximum Eigen value test and the Trace statistic test). to determine the number of cointegrating vectors. The Maximum Eigen-value tests the null hypothesis of r cointegrating relations against the alternative of $r+1$ cointegrating relations for $r = 0,1,2...n-1$ (Sarantis, 1994)

Vector Error Correction Mechanism

Once cointegration status of the series has been confirmed between or among the series, it shows that there exists a long-run equilibrium relationship between them, as such the Vector Error Correction (VECM) is adopted to evaluate the short-run properties of the cointegrated series (Ishioro,2022c). In the case of no cointegration, the VECM is no longer required. The regression equation for the VECM is specified as:

$$\Delta Y_t = \varpi_1 + \kappa_1 e_1 + \sum_{i=0}^{n} \beta_i \Delta Y_{t-1} + \sum_{i=0}^{n} \gamma_i \Delta X_{t-1} + \sum_{i=0}^{n} \phi_i \Delta Z_{t-1} \qquad (5)$$

$$\Delta X_t = \varpi_2 + \kappa_2 e_{i-1} + \sum_{i=0}^{n} \beta_i \Delta Y_{t-1} + \sum_{i=0}^{n} \gamma_i \Delta X_{t-1} + \sum_{i=0}^{n} \phi_i \Delta Z_{t-1} \qquad (6)$$

In the results of the VECM, the cointegration rank shows the number of cointegrating vectors. A negative and significant coefficient of the ECM (e_{t-1}) in the above equation indicates that any short run fluctuation between the explained and the explanatory variables will give rise to a stable long-run relationship between the variables(Ishioro, 2022a, 2022b, 2022d).

Results and Discussions

We present the results of the unit root test in order to determine the order of integration for each variable studied. This will enable us ascertain the nature of their stationarity.

Results of the Multivariate Unit Root Tests

Table 2: Results of Unit Root Tests

Unit Root	ADF Unit Root Test		PP Unit Root Test		KPSS Unit Root Test	
Variables	Level	First Difference	Level	First Difference	Level	First Difference
CAP	-2.088	-4.902**	-2.459	-8.860**	0.112	0.500**
GDP	-1.630	-3.279**	-1.673	-3.193**	0.171**	0.138***
GEXP	-2.928	-2.369**	-1.745	-4.347**	0.114	0.120***
PSC	3.973 **	-5.176**	-1.877	-5.109**	0.153**	0.472**
REXCH	-5.829**	-4.779**	-5.348**	-5.552**	0.089	0.276**
TOT	-2.279	-4.791**	-2.115	-7.903**	0.135***	0.214**

Source: Author's Computation

Table 2 provides the results of the ADF, PP and KPSS test statistics at both levels and first differences of the variables in our regressions. In the case of economic growth (GDP), the ADF regression with the trend term suggests that the null hypothesis of non-stationarity cannot be rejected. Since GDP is strongly trended at 5 percent, it is said to be stationary. For other macroeconomic fundamentals such as capital account, government expenditure, private sector credit, real exchange rate and terms of trade, the ADF tests provide conclusive evidence that they are integrated of order one, I(1).In summary, the ADF and the Phillips-Perron tests applied to the first difference of the data rejects the null hypothesis of non-stationarity for all variables. The result from the KPSS unit root test suggests different orders of integration for the variables as they are integrated at level and first difference.

Results of the Johansen Cointegration Test

Table 3: Testing for cointegration (Johansen cointegration procedure)

Null Hypothesis	Alternate hypothesis	Trace test		Maximal Eigen Value	
		Trace Statistics	0.05 Critical Value	Maximal Eigen Statistics	0.05 Critical Value
CV=0	CV=1	254.828	95.753	104.284	40.077
CV≤1	CV=2	150.543	69.818	73.434	33.876
CV≤2	CV=3	77.109	47.856	48.184	27.584
CV≤3	CV=4	28.924	29.797	17.483	21.131
CV≤4	CV=5	11.441	15.494	7.982	14.264
CV≤5	CV=6	2.458	3.841	3.458	3.841

Source: Author's Computation

The Johansen cointegration test procedure starts with the selection of a suitable lag length. We selected the initial maximum lag length of 1. However, the AIC (Akaike Information Criterion) suggested optimal lag order of 2. In the Johansen cointegration test procedure, the variables (growth, capital account, government expenditure, credit to the private sector, real exchange rate and terms of trade) are jointly determined, that is, they are tested together for cointegration. Therefore, table 3 reports the results of the Johansen cointegration tests using both the maximum Eigen value and trace statistic tests. Using the trace statistics test (with lag order of VAR = 2), the null hypothesis of no cointegration is strongly rejected. Similarly, the null hypothesis of CV ≤ 1 is also rejected against the alternative of at least two Cointegrating Vectors.

Results of Vector Error Correction Model

The presence of cointegration between variables suggests a long-run relationship among them. Then, the VEC model was applied and the long-run relationship between exchange rate, government consumption expenditure, private sector credit, terms of trade and economic growth for Nigeria.

Table 4: Vector Error Correction Results

VECM Long-run Relationship							
	GDPg(-1)	LNGEXPD(-1)	LNPSC(-1)	LNREXCH(-1)	LNTOT(-1)	CAP(-1)	C
CointEq1	1.000	-0.636 (-1.474)	1.338 (0.887)	-0.904 (5.526)**	-3.868 (-3.907)**	0.312 (5.452)**	23.696
$ECT_{t-1} = \{1.000GDP_{t-i} - 0.636LNGEXPD_{t-j} + 1.338LNPSC_{t-m} - 0.904LREXCH_{t-n} - 3.868LNTOT_{t-p} + 0.312CAP_{t-r} + 23.696$							
VECM Short-Run Relationship							
	D(GDPg)	D(GEXPD)	D(LNPSC)	D(LNREXCH)	D(LNTOT	D(CAP)	C
CointEq1	-1.183 (-5.025)**	-0.004 (-0.129)	0.046 (3.095)**	-0.011 (-0.393)	-0.026 (-1.668)	-0.658 (-1.745)	0.388 (0.539)
D(GDPg(-1))	0.207 (1.199)	0.012 (0.482)	-0.018 (-1.654)	-0.011 (-0.540)	0.008 (0.772)	0.4996 (1.799)	0.155 (1.457)
D(LNGEXPD(-1))	0.740 (0.519)	-0.171 (-0.813)	0.052 (0.580)	-0.013 (-0.076)	0.057 (0.597)	3.659 (1.600)	0.066 (1.438)
D(LNPSC(-1))	0.203 (0.071)	0.334 (0.796)	-0.140 (-0.775)	0.134 (0.378)	0.151 (0.798)	-2.586 (-0.569)	0.230 (2.520)
D(LNREXCH(-1))	-1.169 (-0.758)	-0.206 (-0.901)	-0.116 (-1.180)	0.240 (1.2278)	0.204 (1.970)***	4.082 (1.649)	-0.069 (-1.443)
D(LNTOT(-1))	-5.561 (-2.215)**	0.498 (1.340)	0.293 (1.828)***	-0.207 (-0.652)	-0.298 (-1.767)	-3.670 (-0.911)	0.106 (0.509)
D(CAP(-1))	0.231 (1.773)	0.005 (0.295)	-0.022 (-2.642)**	-0.010 (-0.608)	0.020 (2.305)**	0.106 (0.509)	-1.680 (-1.454)

Source: Author's Computation

The estimated long-run relationship permits us to model the corresponding short-run dynamic adjustments using the vector error-correction mechanism. With the establishment a valid long-run relationship, there exists one corresponding vector error-correction model (VECM). Given the OLS relationship, it is possible to obtain six short-run VECMs with our results showing that they are different from one another.

In the short run, credit to the private sector fails to register any significant effect, the magnitude irrespective in all columns. The long-run effect of private sector credit also shows an insignificant effect on economic growth. The magnitude of the short-run government consumption expenditure elasticity in the first column is relatively high; implying that a 1 per cent increase in government consumption expenditure is associated with only about 0.74 per cent increase in growth. The effect, however, is not significant. This is reflected also in the long-run relationship with a negative and insignificant relationship to growth. The terms of trade effect is negative, and the estimated short-run coefficient is significant at about 5 per cent level. This is also true in the long-run relationship. From real exchange rate, it is observed that in contrast to its short-run results, the estimated long-run effect is negative and statistically significant. This implies that the results suggest a contractionary impact of domestic currency depreciation in the long-run. The estimated short-run effect is negative though not statistically significant (see column one). The effect is relatively large, such that, a 1 per cent real devaluation is associated with over 100 per cent decline in GDP, though not significant. However, with the improvement in the incentive structure for resource allocation in favour of the more productive tradable sector, and given its enhanced competitiveness, the expansionary effect is felt in the long-run. Finally, the VECM, as shown in column one is correctly signed and highly significant at the 5 per cent level, indicating a valid representation of the VECM. The coefficient suggests that it takes more than a decade to correct all short-run disequilibrium errors.

Results of Granger Causality Test

This aspect of our study seeks to verify the direction of Granger Causality between economic growth, government consumption expenditure, private sector credit, terms of trade and capital account. Results for Granger causality between the various variables are presented in table 5:

Table 5: Results of Granger Causality Test

Null Hypothesis	Chi-square statistics	Probability	Causality Decision
GDPg does not Granger cause LNREXCH LNREXCH does not Granger cause GDPg	0.574 0.291	0.448 0.589	No causality
GDPg does not Granger cause LNTOT LNTOT does not Granger cause GDPg	4.907 0.596	0.026** 0.440	GDPg $\Rightarrow$ LNTOT
GDPg does not Granger cause CAP CAP does not Granger cause GDPg	3.144 3.236	0.076*** 0.072**	GDPg $\Leftrightarrow$ CAP
GDPg does not Granger cause LNPSC LNPSC does not Granger cause GDPg	0.005 2.736	0.942 0.098***	LNPSC $\Rightarrow$ GDPg

Source: Author's Computation

Table 5 presents the relevant Granger causality results involving real exchange rate, terms of trade, capital account, credit to the private sector and economic growth. The results show that the null hypothesis the 'REXCH does not *Granger cause* GDPg and GDPg does not *Granger cause* REXCH' at (0.291) and (0.574) respectively, is less significant at 5 percent level, thereby accepting the null hypothesis. On the other hand, the capital account which constitutes a component of the BOP suggests that there is a bi-directional relationship between economic growth and the capital account position at the conservative 10 percent statistical significance level. Likewise, private sector credit and terms of trade *Granger causes* economic growth in one direction running from economic growth to trade at 5 percent statistical significant level and from private sector credit to economic growth at the conservative 10 percent statistical significance level.

Conclusion and Policy Implications

We have examined the relationship between EXCRs and macroeconomic fundamentals, and Nigeria's growth performance. Using a suitable model, the study adopted an empirical specification that posits a long-run relationship between growth of GDP and vectors of variables such as terms of trade, government consumption expenditure, credit to the private sector, capital account and the real exchange rate. Our results provide several important conclusions:

Despite a steady rise in the Nominal Exchange Rate, Nigeria's real external competitiveness as measured by the real Exchange Rate has drastically experience increasing trend since the 1980s. Nominal devaluations have largely accounted for cancelling out the differential inflation rates of the Nigerian national economic and wealth creating activities vis-à-vis its trading partners.

The movements in the real exchange rate do affect overall output, and the effect is borne out even after controlling for other variables.

The average real exchange rate elasticity is estimated to be -0.904, implying that a 1 per cent real depreciation of the Naira would lead to 0.90 per cent reduction in the growth of GDP. However, in the short run, the impact of devaluations is likely to be contractionary also. The effect is relatively large, implying that a 1 per cent real devaluation is associated with more than half per cent decline in the growth of GDP.

Several policy implications can be derived from these findings.

Real devaluations turn out to be expansionary, which can operate through two possible channels: by enhancing external competitiveness, they can help expand exports, and real exchange rate depreciations can also improve the competitiveness of the import-competing sector, supporting its growth.

Also, unlike the results of the long-run test, real exchange rates depreciation have contractionary effects in the short run. It is possible that in the short run, various adjustments are taking place in terms of resource allocations

while absorbing certain price shocks triggered by downward movements in the currency. In the long run, this can result in exacerbating inflationary pressure.

Furthermore, it should be noted here that nominal devaluations may not always translate into real exchange rate depreciations. Fiscal and monetary policies in particular must be consistent with the exchange rate regime to tackle the problem of rising prices. That is why we conclude that using real exchange rate as a policy instrument to regulate output and thus economic growth may eventually become a very unpleasant / difficult option.

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