Real Exchange Rate and Macroeconomic Performance: Testing for the Balassa-Samuelson Hypothesis in Nigeria

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Abstract

The study examine whether a link exists between the Naira real exchange rate and macroeconomic performance and test for the existence of 'Balassa-Samuelson' (1964) hypothesis in Nigeria. Using data covereing 1970 to 2009, the Parsimonious ECM result shows that the one period lag value of technological productivity has a negative sign and is statistically significant. This suggests the existence of the Balassa-Samuelson hypothesis in Nigeria. The Johansen Cointegration Test suggests a long run relationship among technological productivity, foreign private investment, the ratio of government expenditure to GDP and the real effective exchange rate. It is thus recommended that the government and policy makers should continue to employ policies that could increase productivity in all sectors of the economy to enhance exchange value of the Naira

Keywords: Real exchange rate, cointegration, Balassa-Samuelson and Macroeconomic performance

1. Introduction

The role of the real exchange rate in the economic performance of both developed and developing economies such as Nigeria constitutes one of the greatest macroeconomic policy debate. There is increasing agreement among economists and policy makers that while stability in the real exchange rate promotes economic growth and improved standard of living, misaligned real exchange rate hinders export growth and generates macroeconomic instability (Chowdhury, 1999). Thus, getting the exchange rate right or maintaining relative stability is critical for both internal and external balance and, hence growth in an economy. Failure to properly manage the real exchange rate induces distortions in consumption and production patterns particularly for an import dependent country. Fluctuations in real exchange rate have a destabilizing effect on the macro economy (Obadan, 2006). Private operators are also concerned about the exchange rate's fluctuations because it impacts on their portfolios, and may result in capital gains or losses (Balogun, 2007). This is because the real exchange rate reflects the international competitiveness as well as serves as nominal anchor for domestic prices. Real exchange rate misalignment affects economic activity in developing countries primarily due to the dependence of imported capital goods and specialization in commodity exports. Exchange rate policy guides investors in the best way they can strike a balance between their trading partners, and investing at home or abroad (Balogun, 2007).

Despite various efforts by the government to maintain exchange rate stability in Nigeria (as well as avoiding its fluctuations and misalignment) in the last two decades, the naira exchange rate to the American dollar depreciated throughout the 1980s. For example, the naira depreciated from N0.61 in 1981 to N2.02 in 1986 and further to N8.03 in 1990. Although the exchange rate became relatively stable in the mid 1990s, it depreciated further to N120.97, N129.36 and N133.50 in 2002, 2003 and 2004 respectively (Obadan, 2006). Thereafter, the exchange rate appreciated to N132.15, N128.65, N125.83 and N118.57 in 2005, 2006, 2007 and 2008 respectively (Central Bank of Nigeria(CBN), 2008).

The fluctuations in the real exchange rate in Nigeria have affected producers' revenues and costs; including their profit margin. Some of the factors that led to the instability in the real exchange rate in Nigeria include but not limited to: weak production base, import-dependent production structure, fragile export base and weak non-oil export earnings, expansionary monetary and fiscal policies, inadequate foreign capital inflow, excess demand for foreign exchange relative to supply, fluctuations in crude oil earnings, unguided trade liberalization policy, speculative activities and sharp practices (round tripping) of authorized dealers, over reliance on imperfect market, heavy debt burden, weak balance of payments (BOP) position and capital flight (Obadan, 2006).

The main objective of this paper is thus to assess empirically, the link(s) between the real exchange rate and some macroeconomic indicators in Nigeria. Specifically, the study attempts to test empirically the existence of the so-called Balassa-Samuelson (1964) hypothesis which states that rapid economic growth is accompanied by real exchange rate appreciation due to differential productivity growth between tradable and non-tradable sectors. Although considerable empirical research on the Balassa-Samuelson effects based on time series data especially for the developed countries abound, this is not the case for Nigeria. This study attempts to fill such gap. The remainder of this paper is organised in sections. Following this introduction, section 2 presents a review of related literature. Section 3 deals with the econometric procedure and discussion of results while section 4 concludes.

2. Literature Review

Balassa (1964) established that if productivity in the domestic traded goods sector grows more rapidly than productivity in the non-traded goods sector, under the assumption of equalization in wages across sectors, the relative price between traded and non-traded goods has to fall. Since the prices of traded goods are equalized between countries through international arbitrage, the general price level will rise at home and the real exchange rate (REER) will appreciate. Klau (1998) investigated the impact of real exchange rate on inflation and output for twenty-two sub-Saharan countries and found that real devaluation increase both output and inflation. Vo, Dinh, Do, Hoang and Phan, (2000) employed a single equation model to examine the impact of real devaluation on output in Vietnam and showed that devaluation of real exchange rate increased output in both the short and long run. Odusola and Akinlo (2001) in their study on the impact of real exchange rate on output and inflation in Nigeria found that devaluation reduced output and increased inflation. Nguyen and Kalirajan (2006), using monthly data from 1991 to 1999 and vector autoregression approach, investigated the impact of nominal effective exchange rate on inflation in Vietnam and found that the impact of nominal devaluation on inflation is positive.

Edwards (1989), Edwards (1994), Williamson, (1994) analysed the relative importance of monetary and real variables in the process of real exchange rate determination in both the short and long-run. It was used to capture macroeconomic features of developing economies, such as the existence of exchange controls, trade barriers and a market-determined parallel exchange rate for financial transactions These studies provided the theoretical anchor for the present study.

Balassa-Samuelson effect presupposes that productivity differences in the production of tradable goods across countries can introduce a bias into the overall real exchange rate, because productivity advances tend to be concentrated in the tradable goods sector; the possibility of such advances in the non-tradable goods sector is limited. If a country experiences an increase in the productivity of the tradable goods sector, relative to its trading partners and non-tradable goods sector, demand for labour in the tradable goods sector increases causing the non-tradable goods sector to release labour to the tradable goods sector. Higher wages in the tradable goods sector pull labour out of the non-tradable goods sector. At a given real exchange rate, the tradable goods sector, expands while the non-tradable goods sector contracts. The supply of non-tradable goods accordingly contracts creating excess demand in the sector and ultimately higher prices of non-tradable goods. This will require a real appreciation of the exchange rate in order to restore internal balance.

At the same time, the increase in the production of tradable goods and a decline in their relative price creates an incipient trade surplus, as more of the country's tradable goods output is demanded in the world markets. As in the previous case, a real appreciation of the exchange rate is also required for the restoration of external balance. Thus, an increase in differential productivity growth in the tradable goods sector creates an appreciation of the real exchange rate (Edwards, 1994; Montiel, 1999).

The impact of government consumption on the real exchange rate depends on whether such spending is predominantly on tradable goods or on non-tradable goods. An increase in government spending on tradable goods creates a trade deficit, which requires a real depreciation in the exchange rate in order to maintain external balance. The real depreciation in the exchange rate induces an increase in the production of tradable goods, allowing an increase in total spending on tradable goods. In contrast, an increase in government spending on non-tradable goods leads to an increase in their relative price in order to maintain equilibrium in the non-tradable goods market. An increase in the relative price of non-tradable goods, in turn, appreciates the real exchange rate (Edwards, 1994 and Montiel, 1999). Thus, the real exchange rate is a function of the sectoral composition of government spending, with an increase in government spending on tradable goods leading to a depreciation of the real exchange rate, and when its increase falls heavily on nontradables, the real exchange rate appreciates.

Montiel (1999) showed that changes in the level of international transfers received by the domestic economy have an impact on the equilibrium real exchange rate. An increase in this variable results in an addition to household incomes equal to the amount of the transfer. Additional transfer income permits an expansion of consumption which, in turn, will raise the price of non-tradable goods and eventually an appreciation of the real exchange rate (Montiel, 1999). Edwards and Montiel differed on the treatment of capital flows in their models. Edwards assumes that net capital flows are restricted to the government and are exogenous. On the other hand, Montiel assumes that the volume of capital inflows is an endogenous variable that can arise from a variety of changes in domestic and external economic conditions. However, the two are in agreement that an increase in capital inflows permits an expansion of absorption and consequently an appreciation of the real exchange rate (Edwards, 1994 and Montiel, 1999). Another way capital flows affect the real exchange rate is through an appreciation in the nominal exchange rate. Under a flexible exchange rate regime, as in Nigeria, an increase in net capital inflows produces an excess supply of foreign exchange which, in turn, leads to an appreciation of both the nominal and real exchange rates, assuming that prices are slow to respond.

From the foregoing we specify our model thus:

$LREER = a_0 + a_1 LTECHPRO + a_2 LGSPGDP + a_3 LFPI + \mu_t$

Where:

REER = Real Effective Exchange Rate

TECHPRO = Technological productivity (Balassa-Samuelson Hypothesis)

FPI = Foreign Private Investment

GSPGDP = The ratio of government spending to Gross Domestic Product

L = Natural logarithm

3. Econometric Procedure

3.1 VAR Modelling and the Cointegration Approach

Vector Autoregression (VAR) modelling and the cointegration approach provide not only an estimation methodology but also explicit procedures for testing the long-run relationship among variables suggested by economic theory. The Granger Representation Theorem (Engle and Granger, 1987) sates that if a P*1 vector, X_t, generated by $(1\text{-}L)X_t = d + c(L)\, e_t$, is cointegrated, then a vector autoregression (VAR), an error correction, as well as a moving average (MA) representation of X_t exist. A set of variables X_t, which is cointegrated, refers to the existence of long-run equilibrium relationship among economic variables. That is, though each series may be non-stationary, there may be linear combinations of the variables that is stationnary. The basic idea is that individual economic time series variables wander considerably, but certain linear combinations of the series do not move too far apart from each other. In economic terms, there is a long-run relationship among such variables.

One common test for cointegration is the two-step procedure of Engle and Granger (1987). The first step is to fit the cointegration regression, using an ordinary least squares (OLS) estimation of the static model. The second step is to conduct a unit root test on the estimated residuals. To test for cointegration is just to test for the presence of a unit root in the residuals of the cointegrating regression. If we reject the null of a unit root, then cointegration exists. However, the long-run parameter of the cointegrating vector estimated from this approach can be severely biased in finite samples. An improved procedure of cointegration test is that which allows for more than one cointegrating vector, as suggested in Johansen (1988) and Johansen and Juselius (1990).

Following Johansen and Juselius (1990), let the p variables under scrutiny follow a vector autoregression of order p (VAR(p)) as below,

$$X_t = c + P_t X_{t-1} + \ldots + P_p X_{t-p} + e_t \tag{1}$$

Where, X_t = *nxl* vector of economic variables in the model; c = *nx1* vector of constants or drift terms are innovations of this process and are assumeed to be drawn from p-dimensional independently, identically distributed (i.i.d.) Gaussian distributions with covariance G; and $X_{p+1}, \ldots \ldots X_0$ are fixed.

Where:

Pi = nxn matrixes of time invariant coefficients, I = 1,…., p, and

e = nx! Vector of i.i.d. errors with a positive covariance matrix.

Let Δ represent the first difference filter. The equation can be reparameterized into the equivalent form presented below,

$$\text{Where} \Delta X_t = c + PX_{t-p} + \sum_{i=0}^{p-1} \tau_i \Delta X_{t-i} + \tau_i \quad (2)$$

$$\tau_i = -\tau + \sum_{j-1}^{i} P_{j,} for, i = 1, \ldots, \rho - 1, \rho = \tau + \sum_{i}^{p} P_{j,}$$

The coefficient matrix *P* contains information about the long-run relationships among variables. Since e_t is stationary, the number of ranks for matrix *P* determines how many linear combinations of X_t are stationary. If 0 < Rank (*P*) = r<p, there exists r cointegrating vectors that make the linear combinations of X_t become stationary. In that case, *P* can be factored as "a" and "b", with "a" and "b" being matrixes. Here "b" is a cointegrating vector that has the property that bX_t is stationary even though X_t itself is non-stationary and "a" then contains the adjustment parameters.

Based on an unrestricted estimation that is parameterized in terms of levels and differences, Johansen (1988) proposed likelihood ratio statistics for testing the number of cointegrating vectors. First we must solve the eigenvalues of $I\lambda S_{pp} - S_{p0}S_{00}^{-1}S_{0p}$ I = 0, where S_{00} is the moment matrix of the residuals from the ordinary least squares (OLS) regression of DX_t on ΔX_{t-1} …. ΔX_{t-p+1}; S_{pp} is the residual moment matrix from the OLS regression of ΔX_{t-p} on ΔX_{t-1}…………… ΔX_{t-p+1}; and S_{0p} is the cross-product moment matrix. The cointegrating vector, b, is solved out as the eigenvectors associated with the r largest statistically significant eigenvalues derived using two test statistics, "maximum eigenvalue statistics" and "trace statistics". The first statistic tests the hypothesis that there are r=s cointegrating vectors against the alternative of r=s+1 by calculating the maximum likelihood test statistics as $-T.ln(1-l_{s+1})$, where T is the sample size and l_{s+1} is an estimated eigenvalue. The second statistic tests the hypothesis that there exists at most, r cointegrating vectors. If the test is performed by calculating trace statistics:

$$-T \sum_{i=r+1}^{p} \ln \{(1 - \lambda i^*)/(1 - \lambda i)\}$$

Where λi^* are eigenvalues obtained from cointegration analysis assuming there is no linear trend.

3.1.1 Unit Root Test

Before proceeding to the cointegration test, we first test for the presence of unit root on the real effective exchange rate, technological productivity, foreign private investment and the ratio of government spending to Gross Domestic Product (GDP). The Augmented Dickey-Fuller (ADF) unit root procedures have stood the test of time as it appears to give good results over a wide range of applications (Greene, 2004). Nevertheless several other alternative testing procedures have been developed to accommodate more general formations. We use the ADF and Eliot, Rothenberg and Stock (1996) procedures to test for unit roots in the variables of our model. The results are reported in table 3. All the variables are I (1) except LGSPGDP which is I(0). However, Harris (1995) and Gujarati (2003) showed that it is not necessary for all the variables in the model to have the same order of integration, especially if theory 'a priori' suggests that such variables be included. We therefore carry all the variables along to test for the existence or not of a long run relationship among the variables. The result of the ADF unit root test is shown in table 3.

3.1.2 Cointegration Test Results

When two or more time series are non-stationary, we can therefore test whether a linear combination of the variables are stationary. The result in table 1 suggests that a long run relationship exists among the REER, GSPGDP, TECHPRO and the FPI. As can be seen from table 1, both the trace test and max-eigenvalue test indicate a cointegrating equation at the 5% level.

3.1.3 Short Run Dynamics of the REER and Macroeconomic Performance

A short run error correction (ECM) model is justified by the existence of at least one cointegrating equation. A summary of the Parsimonious ECM result is shown in table 2. The result shows that, although the current level of technological progress is wrongly signed and not significant, the one period lag value of technological progress is statistically significant. The results suggest further that an increase in technological productivity in the previous year by 1 percent will appreciate the real effective exchange rate by 28 percent. This is an indication that the so-called Balassa-Samuelson hypothesis holds in Nigeria. Ito et al (1997), Ehsan and Khan (2004) reported similar results for selected Asian economies and developing countries respectively. This is also an indication that in Nigeria, there seems to be a bias in the overall real exchange rate, because productivity advances tend to be concentrated on the tradable goods sector. The possibility of these advances in the non-tradable goods sector seems to be limited. This is also not unconnected to the increasing drive by the Nigerian government to increase total export, which seems to still be dominated by oil export.

The result in table 2 further shows that the one period lagged value of foreign private investment which is a form of capital inflow is statistically significant in explaining the changes in the real effective exchange rate. The negative sign attached to the foreign private investment suggests that a 1 percent increase in the foreign private investment appreciates the real effective exchange rate by 45 percent. This is an indication of the existence of the Dutch disease syndrome in Nigeria. The result also suggests that the ratio of government spending to the Gross Domestic Product is statistically significant. This is an indication that both government's consumption and investment appreciates the real effective exchange rate. Thus an increase in government spending appreciated the real effective exchange rate by 46 percent.

4. Conclusion

The focus of this paper was to examine the link between the real effective exchange rate and macroeconomic performance with special focus on testing the existence of the Balassa-Samuelson effects. The result of the Johansen cointegration test suggests that a long-run relationship exists among the level of technological productivity, foreign private investment, the ratio of government expenditure to Gross Domestic Product and the real effective exchange rate in Nigeria. The Parsimonious ECM result suggests that the one period lag value of technological productivity, one period lag value of foreign private investment and the ratio of government spending to Gross Domestic Product appreciates the real effective exchange rate.

It is thus recommended that the government and policy makers should continue to employ policies that could increase productivity in all sectors of the economy. This could be through investment in both the private and public sectors. Also, government consumption should encourage and promote investment which will increase domestic demand.

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Table 1. Summary of Johansen Cointegration Test

Unrestricted Cointegration Rank Test				
Hypothesized No. of CE(s)	Eigenvalue	Trace Statistic	5 Percent Critical Value	1 Percent Critical Value
None*	0.558643	54.19254	47.21	54.46
At most 1	0.379811	23.93021	29.68	35.65
At most 2	0.130753	6.254172	15.41	20.04
At most 3	0.028490	1.069430	3.76	65.65
*(**) denotes rejection of the hypothesis at the 5%(1%) level Trace test indicates 1 cointegrating equation(s) at the 5% level Trace test indicates no cointegration equation(s) at the 1% level				
Hypothesized No. of CE(s)	Eigenvalue	Max-Eigen Statistic	5 Percent Critical Value	1 Percent Critical Value
None*	0.558643	30.26232	27.07	32.24
At most 1	0.379811	17.67604	20.97	25.52
At most 2	0.130753	5.18742	14.07	18.63
At most 3	0.028490	1.069430	3.76	6.65
*(**) denotes rejection of the hypothesis at the 5%(1%) level Max-eigenvalue test indicates 1 cointegrating equation(s) at the 5% level Max-eigenvalue test indicates no cointegration equation(s) at the 1% level				

Source: Authors' calculations

Table 2. Summary of Parsimonious ECM Result: Modelling DLREER

Variable	Coefficient	Std. Error	t-Statistic	Prob.
DLTECHPRO	0.000306	0.021127	0.014499	0.9885
DLTECHPRO(-1)	-0.283921	0.135872	-2.089620	0.0440
DLGSPGDP	-0.461316	0.160090	-2.881610	0.0071
DLFPI(-1)	-0.449361	0.135530	-3.315583	0.0023
ECM(-1)	-0.843213	0.137699	-6.123596	0.0000
C	-0.124655	0.54062	-2.305783	0.0280
R-Squared	0.631958	Akaike info criterion		0.308613
Adjusted R-squared	0.620984	Schwarz criterion		0.569843
Log likelihood	0.290652	F-statistic		22.91208
Durbin-Watson stat	2.200076	Prob(F-statistic)		0.000000

Source: Authors' calculation

Table 3. Summary of ADF Unit Root Test Result

Variables at level	**ADF t-statistic**	**Order of integration**	**DF-GLS (ERS) t-statistic**	**Order of integration**
LFPI	-0.243276	I(1)	-1.2128	I(1)
LEER	-1.647924	I(1)	-0.7477	I(1)
LTECHPRO	-2.820333	I(1)	-1.0615	I(1)
LGSPGDP	-4.375296*	I(0)	-5.9673*	I(0)

* Significance at the 1% level

Table 4. Summary of overparameterized ECM Result: Modelling LREER

Variable	Coefficient	Std. Error	t-Statistic	Prob.
DLTECHPRO	0.009748	0.024253	0.401945	0.6911
DLTECHPRO(-1)	0.053192	0.024896	2.136584	0.0426
DLTECHPRO(-2)	0.047429	0.025052	1.893216	0.0700
DLGSPGDP	-0.479142	0.196846	-2.434094	0.0205
DLGSPGDP(-1)	-0.083604	0.053743	-1.555627	0.1324
DLGSPGDP(-2)	-0.000197	0.050200	-0.003915	0.9969
DLFPI	-1.208251	0.246136	-4.908867	0.0000
DLFPI(-1)	0.401676	0.232305	1.729090	0.0961
DLFPI(-2)	0.255399	0.231823	1.101695	0.2811
ECM(-1)	-0.648557	0.155729	-4.164638	0.0002
C	-0.161179	0.067820	-2.376591	0.0254
R-Squared	0.657666	Akaike info criterion		0.395948
Adjusted R-squared	0.624073	Schwarz criterion		0.879801
Log likelihood	3.872931	F-statistic		22.10971
Durbin-Watson stat	2.117067	Prob(F-statistic)		0.000000

Table 5. Breusch-Godfrey Serial Correlation LM Test

F-Statistic	1.918921	Probability	0.164945
R-Squared	4.324283	Probability	0.115078
White Heteroskedasticity Test			
F-Statistic	1.395770	Probability	0.236657
R-Squared	12.92454	Probability	0.227922

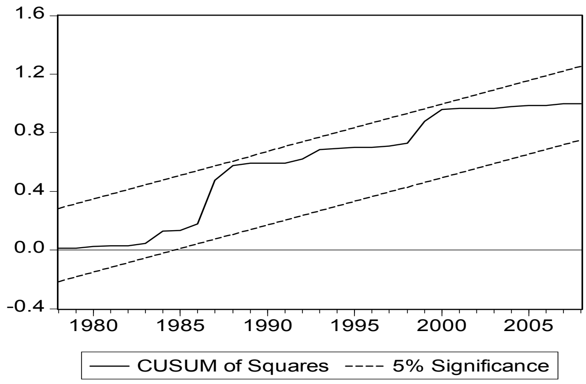

Figure 1. CUSUM Stability Test

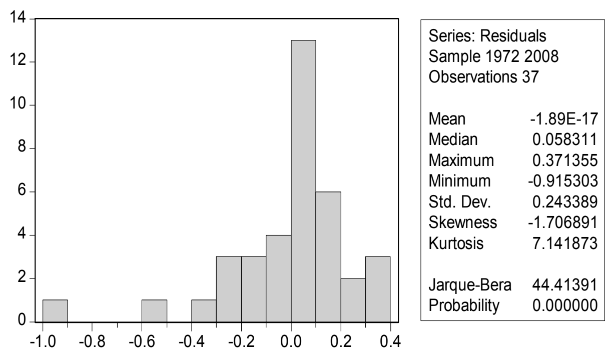

Figure 2. Normality Test