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External reserve holdings in Nigeria: Implications for investment, inflation and exchange rate

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The paper investigates the impact of change in external reserve positions of Nigeria on domestic investment, inflation and exchange rates. Using a combination of Ordinary Least Square (OLS) and Vector Error Correction (VEC) methods, it was observed that change in external reserves in the country only influences Foreign Direct Investment (FDI) and exchange rates and no influence of it was found on domestic investment and inflation rates. The results suggest that there is the need for broader reserve management strategies that will aim at maximizing the gains from oil export revenue by utilizing more of these resources to boost domestic investment.

Key words: External reserve, inflation rate, exchange rate, vector error correction.

INTRODUCTION

In the past few years, reserves accumulation has mainly been associated with emerging Asian economies following the Asian financial crisis of the early 90's. Today, it has become a global phenomenon traversing oil exporting nations and other non renewable resource dependent economies.

For Nigeria, the period beginning from the later end of 1999 marked a turning point from a hitherto culture of fiscal indiscipline characterized by frivolous spending to a new dawn of prudent consumption and saving. This is evident from an unprecedented accumulation in the level of reserves from USD4.98 billion in May 1999 to USD59.37 billion as at March 28, 2007 (CBN, 2007). These robust domestic economic performances according to Magnus (2007) were occasioned by macroeconomic fundamentals like internal reforms, complemented by favourable external conditions like the persistent and unprecedented rise in crude oil prices joined with drastic decline in external obligations like debt service.

The recent growing of external reserve is not a phenomenon that has been unique to Nigeria; most of the South East Asian as well as Latin American economies have also been indulging in this kind of behaviour. For instance, Adam and Leonce (2007) noted that global official foreign exchange reserves rose from USD 1.2 trillion in January 1995 to USD 5.04 trillion in December 2006 and the share of developing countries in world reserves increased from 50 to 72% over the same period These developments according to Magnus (2007) consequently underscored the critical role of foreign exchange reserve in the balance sheets of Central Banks and monetary policy operations, generating renewed and ranging controversies among scholars and analysts in the process. Mostly the bone of contention has been on issues like the adequacy of reserves, the alternatives uses to which these reserves should be put, the costs and benefits of holding excess reserves etc.

Common to every economic phenomenon, these developments has earned the praises of many as it equally drew severe criticisms from others who question the rationale for building reserves in the face of crippling domestic economic activities and high incidence of poverty in the country. However, this paper intends to provide empirical evidence on the implications of holding reserves on domestic investment, inflation and the exchange rate in the country. The results we believe will contribute to the literature on the desirability or otherwise of holding reserves by countries such as Nigeria.

The rest of the paper is structured as follows. Section 2 presents the literature and the theoretical framework; Section 3 deals with research methodology, Section 4 presents and analyze the results while in Section 5 we conclude.

LITERATURE/THEORETICAL FRAMEWORK

External reserves according to IMF (1993) "consist of official public sector foreign assets that are readily

available to, and controlled by the monetary authorities, for direct financing of payment imbalances, and directly regulating the magnitude of such imbalances, through intervention in the exchange markets to affect the currency exchange rate and/or for other purposes.

The Central Bank of Nigeria (CBN) Act 1991 vests the custody and management of the country's external reserves in the CBN. The Act provides that the CBN shall at all times maintain a reserve of external assets consisting of gold, balance at any bank outside Nigeria where the currency is freely convertible; treasury bills; securities of or guarantees by a government of any country outside Nigeria, securities of or guarantees by international financial institutions of which Nigeria is a member; Nigeria's gold tranche at the international monetary fund and allocation of special drawing rights made to Nigeria by the International Monetary Fund. Though the management of foreign exchange reserves of a country is the exclusive responsibility of the Central Bank, the quantum of reserves to be held at any point in time depends on several exogenous factors, depending on its development objective and the prevailing economic management challenges.

The literature suggests that reserves are held for both transaction and precautionary motives (Mendoza, 2004). In principle, countries hold reserves in order to meet unexpected and temporary fluctuations in international payments. In this context, the optimal size of reserves depends on the balance between the macroeconomic adjustment costs that result if reserves are exhausted and the opportunity cost of holding reserves (Heller, 1996). According to Gosselin and Parent (2005) there is a relatively stable long run reserve demand function that depends on five categories of explanatory variables; economic size, current account vulnerability, capital account vulnerability, exchange rate flexibility and the opportunity cost.

Reserve holding is expected to increase with economic size and the volume of international transactions. Thus, in view of the nature of commodity base production and oil export in Nigeria, both the level and growth rate of output are expected to influence reserve accumulation. Increased current and capital account vulnerability should motivate Central banks to hold more reserves, while exchange rate flexibility reduces demand for reserves. Economic theory predicts that the higher the opportunity cost of holding reserves the lower would be the demand for reserves.

In their own contribution, Burkee and Lane (2001) opine that, apart from trade openness, financial depth and external indebtedness also influence the demand for international reserves. Aizenman and Marion (2004) point out that the size of international transactions; their volatility, exchange rate arrangement and political stability are some of the key determinant of international reserve holdings in most East Asian countries. Focusing on Korea, Aizenman et al. (2003) find evidences of a structural break in the pattern of reserve holding post-Asian crisis after which financial openness and external indebtedness became significant and a strong predictor of reserve holdings, while trade openness lost some significance after the crisis.

Transversely, according to Adam and Leonce (2007), to investigate the crowding out effect of external reserves on both public and private investment, real GDP growth, domestic credit to public sector (for public investment) and interest and exchange rates expectations (for private investment) served as additional variables to external reserves. The same authors considered monetary variables such as interest and inflation rates, as additional variables to external reserves in exchange rate equation and finally, only the lag value of inflation rate was added for inflation equation.

RESEARCH METHODOLOGY

In order to investigate the implication of external reserves on investment (foreign direct investment and domestic investment), inflation and exchange rates, the paper first examines various determinants of external reserves in the country by taking a lead from the model of Gosselin and Parent (2005). Thus, simple long run reserve demand equation is specified as follows:

$$RS_t = \beta_0 + \beta_1 RGDP_t + \beta_2 KAV_t + \beta_3 CUV_t + \beta_4 REXH_t + \beta_5 RC_t + U_t \quad \ldots\ldots\ldots \quad (1)$$

Where RS is real reserves over time t, RGDP is the real gross domestic period (measuring economic size), KAV is the capital account vulnerability, CUV represent current account variability, and RC is the opportunity cost of holding reserves. Accordingly, capital account vulnerability is measured by short-term debt/total debt ratio, current account volatility is measured by trade openness/variability ratio, opportunity cost (RC) is the difference between the real return for reserves and the real return to domestic investments (real US treasury bill rate minus real domestic interest rate.

In order to show the equilibrium path of the above model to long-run solution, we estimate a Vector Error Correction (VEC) version of the model in the form of Equation 2 after conducting unit roots and co integration tests on the series used.

$$\Delta RS_t = \beta_0 + \beta_i \Delta Z_{it} - \Theta\, Ecm_{t-1} + U_{2t} \quad \ldots\ldots\ldots \quad (2)$$

Where Ecm = Error correction mechanism, Δ = change, Zit = vector of all variables as defined before.

Apart from investigating the determinants of external reserve holdings of Nigeria, as stated earlier, the study also investigates the linkages between movements in external reserves (change in reserves) and certain economic variables- investment, inflation and exchange rate. To drive home our points, we modified the model used by Adam and Leonce (2007) for some African countries.

To confirm the effect of external reserves on Foreign Direct Investment (FDI) in the country, the model is stated as follows:

$$\Delta RFDI_{it} = \alpha_0 + \alpha_1 \Delta RS_t + \alpha_2 \Delta OPN_t + \alpha_3 \Delta REXH_t + \alpha_4 N_d + \alpha_5 Ecm_{t-1} + U_{3t} \quad \ldots\ldots(3)$$

Where; RFDI = Real Foreign Direct Investment, RS = real external reserve; OPN = Openness of the economy (total trade/GDP ratio); REXH= Real exchange rate; Nd = Niger Delta Crisis dummy; Δ= Change

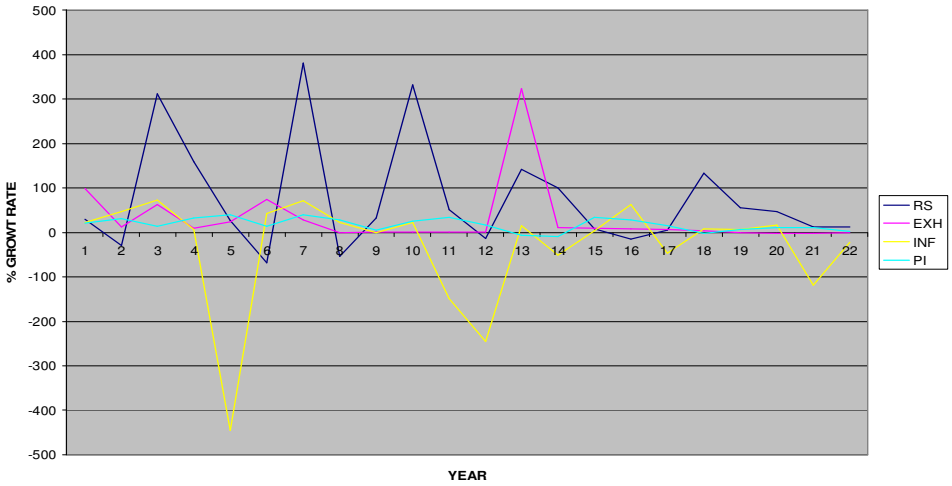

Figure 1. Trends in the growth of reserve, exchange rate, inflation and public investment in Nigeria (1986-2007).

Using analysis of a simple quantity constraint on public investment, which is assumed to depend on real GDP growth and domestic credit to the public sector and foreign exchange reserves, the public investment equation is specified as follows:

$$\Delta PI_t = \alpha_0 + \alpha_1 \Delta RS_t + \alpha_2 \Delta RGDP_t + \alpha_3 \Delta DCt + \alpha_4 ECM_{t-1} + U_{4t} \ldots\ldots\ldots\ldots \quad (4)$$

Where, PI = Public Investment (Domestic Investment); RS = Real external reserve; RGDP = Real gross domestic product; DC= Domestic credit to the public sector.

According to Adam and Leonce (2007), adequate stock of foreign exchange allows monetary authorities to intervene in the market to protect the exchange rate. However, excessive inflows of reserves can cause the currency to appreciate while high volatility of reserves can cause instability in the exchange rate. Thus, they specified an exchange rate equation with the domestic and foreign price and interest rate differentials as the two key explanatory variables besides foreign exchange reserves. The equation is as follows:

$$\Delta EXHt = \sigma_0 + \sigma_1 (i - i^*)_{t-1} + \sigma_2 (p-p^*)_{t-1} + \sigma_3 \Delta RS_t + U_{5t} \ldots\ldots\ldots (5)$$

Where; i = Nominal domestic interest rate; i* = Nominal foreign interest rate (USA rate treasury bill); p = Domestic inflation rate; p* = Foreign inflation rate (USA) price index rate); Other variables as defined earlier.

In the same vain, two possible channels were explored to establish the linkages between external reserves and inflation. The first is the exchange rate expectations channel where with high reserves, agents expect the national currency to appreciate, which in turn reduces (expected) inflation. The second is the liquidity/money market effect where the spending of reserves increases the stock of money which may fuel inflation. In order to investigate this prediction, the inflation equation is stated as follows;

$$\Delta P_t = \Theta_0 + \Theta_1 P_{t-1} + \Theta_2 \Delta RS_t + U_{6t} \ldots\ldots\ldots\ldots\ldots\ldots \quad (6)$$

Alternatively, we also explore the effect of money supply growth and the expected exchange rate on inflation for the country. All variables are as defined before.

Data source and measurement

All data were obtained from the Central Bank of Nigeria (CBN) Statistical bulletin (various issues). The data covered the period between 1986 and 2006. The estimations were carried out using E views 3.1.

ANALYSIS AND DISCUSSION OF RESULTS

The study stated the discussion of results by showing the trends of movement in Nigeria's foreign exchange reserve with co-movements of some major macroeconomic variables (public investment, inflation and exchange rate) under study. The trends are shown in Figure 1.

Nigeria's total external reserves position which stood at a modest USD 2.84 million in 1986 rose to a significant USD 42.30 billion in 2006 and USD 63.1 billion as at November 2008. This represents 49.17% increase from 2006 to 2008. Within these years, external reserve position varies from time to time, while some major economic indications also respond from period to period. For instance, with the level of external reserves at USD 4.5 billion in 1991, exchange rate stood at 49.91% per dollar, inflation rate at 13.0% and domestic investment stood at ₦35.4 million. As at 2006, these variables stood at USD 42.3 million, USD 128.65 million, 8.2% and ₦57.2 million respectively. It can be observed that the trends indicate series of fluctuations which cannot be said without any empirical investigations whether these variables have a direct link with one another. In our subsequent analysis, we shall show with empirical methodologies, the various associations between these variables.

As a preliminary step in testing for co integration and the use of error correction methodology, we employed

Table 1. Augmented Dikkey Fuller (ADF) unit root test.

Variable	ADF Statistics			
	Level	First difference	Lag length	Decision
RGDP	0.1059	-3.0638**	2	I (1)
REXH	-1.3731	-3.2454**	2	I (1)
RFDI	-1.1853	-5.5265*	2	I (1)
OPN	-0.6362	-3.0649**	2	I (1)
PI	0.9799	-3.4216**	2	I (1)
RC	-1.5756	-4.2421*	2	I (1)
KAV	-1.5756	-3.4216**	2	I (1)
CUV	-2.2659	-4.2421*	2	I (1)
RS	-1.0479	-3.966*	2	I (1)
DC	0.3604	-3.1211*	2	I (1)
	-2.7166***	-	2	I (0)

(x), (xx) and (xxx) indicate significance at 1, 5 and 10% respectively.

Table 2. Johansen Co-integration test.

Eigen value	LR	5% critical value	1% critical value	Hyp. No of (ECs)
a. (Equation 2). Assumption: Linear deterministic trend in the data.				
0.7203	65.56	50.72	71.78	None*
0.5507	29.91	38.81	40.67	At most 1
0.3206	12.84	21.94	30.72	At most 2
0.2014	7.61	16.61	19.72	At most 3
0.019	1.32	4.66	7.36	At most 4
b. (Equation 3) Assumption: Linear deterministic trend in the data				
0.8403	74.84	68.52	76.07	None*
0.6507	39.98	47.21	54.46	At most 1
0.4607	19.99	29.68	35.65	At most 2
0.3092	8.26	15.41	20.04	At most 3
0.0629	1.23	3.76	6.65	At most 4
c. (Equation 4) Assumption: Linear deterministic trend in the data				
0.9128	83.17	53.12	60.16	None*
0.7421	36.82	40.67	41.07	At most 1
0.3627	11.07	15.72	24.60	At most 2
0.1239	2.51	5.64	12.97	At most 3

*denotes rejection of the hypothesis at 5% (1%) significance level. L.R. test indicates 1 co-integrating equation at 5% level of significance.

the Augumented Dikey Fuller Unit root test to confirm the stationary or otherwise of the series (variables) used. The results of these tests are shown in Table 1, where all the series except Domestic credit (DC) are found to be integrated order of one.

Tables 2 (a, b, and c) show the Johasen co-integration tests for Equations 2, 3 and 4 respectively. These tests indicate one co-integrating Equation at 5% of significance in each case. The tests further justified the use of Vector Error Correction model for each of this equation and partially guaranteed long run equilibrium for the specified problems.

Equation 1 was estimated using the Ordinary Least Square Method (Table 3) and dynamics specification of the same equation (Equation 2) was estimated using Vector Error Correction (VEC) methods (Table 4). The two methods show similar results as the demand for external reserves in Nigeria has been driven mainly by current account variability, real exchange rate and opportunity cost of holding reserve (measured by the difference between the real return on reserves and the real return on domestic investment). Two of these

Table 3. OLS estimates of Equation 1.

Variable	Coefficient	t-value	Statistic
Constant	-2.78	-1.63***	R^2 = 0.77
RGDP	20.55	1.15	Adj. R^2 = 0.70
KAV	-4.24	-0.21	DW = 1.88
CUV	3.28	1.63***	F-Stat. = 10.19
REXH	5.09	2.02**	
RC	-3.36	-1.67***	

* and **) denotes significance at 5 and 10% level respectively.

Table 4. Error correction model estimates (Equation 2).

Variable	Coefficient	t-value	Statistic
Constant	3.58	1.36	R^2 = 0.65
∆(RGDP)	7.54	0.34	Adj. R^2 = 0.56
∆ (KAV)	-1.22	-0.61	F-Stat. = 18.61
∆(CUV)	1.36	2.64**	
∆ (REXH)	2.04	-2.78**	
∆(RC)	-3.14	-1.76***	
ECM(-1)	-0.59	-4.64*	

*, ** and *** denotes significance at 1, 5 and 10% respectively.

Table 5. Error correction model estimates (Equation 3).

Variable	Coefficient	t-value	Statistic
Constant	1.09	0.08	R^2 = 0.81
∆(RS)	0.12	2.93**	Adj. R^2 = 0.75
∆ (OPN)	-0.64	-1.66***	F-Stat. = 11.73
∆ (REXH)	-1.62	-3.29*	
∆(RC)	-3.42	-0.78***	
ECM (-1)	-0.89	-5.23*	

*, ** and *** denotes significance at 1, 5 and 10% respectively.

variables (current account variability and real exchange rate) have positive and statistically significant coefficients, while the opportunity cost of holding reserves has a negative coefficient and statistically significant. This suggests that external reserve accumulation in Nigeria has not been induced by returns because the result means that as the opportunity cost of the reserve is falling, Nigeria's external reserve is increasing the speed of adjustment (0.59) to equilibrium and this is moderately alright.

In the Equation 3 which shows the determinants of Foreign Direct Investment in Nigeria, external reserves came out positive and significant along side some other variables, such as, openness of the economy and real exchange rate. We introduced a dummy variable (Niger Delta) to cover the major crisis that has bedeviled the area where most of these direct investments are located in the country. The variable (Niger Delta dummy) coefficient came out negative but not statistically significant. When the variable was removed, the performance of Foreign Direct Investment improved from 2% to about 12%, judging from the elasticities of the coefficient (Table 5).

The result of error correction estimates for domestic investment equation is shown in Table 6. Change in external reserves position, though indicates a positive coefficient but proves statistically insignificant. This result suggests that the recent build up in Nigeria's external reserve has not been increasing domestic investment; though, no crowding effect was observed. The most significant variable found was the market size (RGDP).

On the estimates of exchange rate equation, change external reserves have been found to be influential on relative stability of the rates in recent time. The coefficient indicates a 10% increase in external reserve to a 24% appreciation of the Naira against the US dollar. Apart

Table 6. Error correction model estimates (Equation 4).

Variable	Coefficient	t-value	Statistic
Constant	0.74	5.62*	R^2 = 0.96
∆(RS)	0.07	1.42	Adj. R^2 = 0.94
∆ (RGDP)	1.24	2.74**	F-Stat. = 66.01
∆(DC)	2.31	1.04	
ECM (-1)	-0.62	-7.29*	

*and ** denotes significance at 1 and 5% respectively.

Table 7. OLS estimates of Equation 5.

Variable	Coefficient	t-value	Statistic
Constant	0.82	2.20**	R^2 = 0.68
i-i*	-0.01	-0.76	Adj. R^2 = 0.67
P – p*	-0.02	-2.85**	DW = 2.10
∆RS	0.24	0.26	F-Stat. = 19.64
Ecm (-1)	-0.62	-7.29*	

* and ** denotes significance at 1 and 5% level.

Table 8. OLS estimates of Equation 6.

Variable	Coefficient	t-value	Statistic
Constant	12.5	1.8***	R^2 = 0.81
Pt-1	0.48	2.44**	Adj. R^2 = 0.80
∆RS	0.005	0.56	DW = 1.90
			F-Stat. = 10.64

(**) and (***) denotes significance at 5 and 10% respectively.

from this variable, price differentials (p-p*) also proved significant in influencing exchange rates in Nigeria (Table 7).

Lastly, the estimates of determinants of inflation are shown in Table 8. Change in external reserves showed no significant relationship with inflation rate in Nigeria. When substituted with growth of money supply (M_2 growth), the coefficient indicates a positive sign and proves statistically significant. The implication of this result is that changes in external reserve position for Nigeria has no impact on inflation rate but the domestic money supply should be a control variable to regulate domestic inflation rates. In any case or need for sterilization, it should be carried out with caution.

Conclusion

The paper has investigated the possible influence of a continuous external reserve accumulation on public investment, inflation and exchange rates in Nigeria. The empirical evidences show that growth in the reserve of Nigeria is not influenced by the opportunity cost of reserves but by other determinants such as, exchange rates stability and current account variability.

Also, some other important inferences that can be drawn from this work are that; change in external reserve has been having a positive influence on the growth of Foreign Direct Investment and exchange rate appreciation in the country but no such influence were observed on domestic investment and inflation rates in the country within the period under review.

In all, these results suggest that the Nigerian government need to reconsider her reserve management strategies as the results show that reserves holding by this country can not be justified by its opportunity cost. Strategies with a broader economic development policy framework that will aim at maximizing the gains from oil export revenues by utilizing more of these resources to boost domestic investment should be considered.

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