

Causality between External Reserves, Economic Growth, Import, Money Supply and Public Debt Servicing: Evidence from Nigeria

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Abstract

The issue of International Reserves have taken a prominent place among scholars over the years, basically due to the importance of globalization. International transactions to a great extent depends on foreign reserves, which in turn is a function of production (GDP). This reserves determines a nation's capacity to import, as well as the power of her currency. This paper examines the importance of holding international reserves and the causal relationship existing between the reserves maintenance, economic growth and import. The study discovered that foreign reserves improve economic growth in Nigeria as an insurance and interventionist mechanism, as well as also, ascertaining that within the short and long run periods a reduction on import greatly improves the nation's foreign reserves. The study recommended among others the need to reduce import, especially on consumption and frivolities, for there to be an improvement on foreign reserves and by extension GDP.

Keywords: Foreign Reserves, Economic Growth, Import and Granger Causality

1 INTRODUCTION:

International or Foreign reserves in the form of Foreign Assets are those liquid external assets under the control of CBN that possess two basic qualities- (i) Must be acceptable at all times to foreign economic units for payments of financial obligations. (ii) Their value expressed in foreign units of accounts should be known with the certainty. From the above, we can discern four assets that qualify as reserves as (a) official holding of gold (ii) special drawing rights (SDRs) (iii) convertible foreign exchange and (iv) Unconditional drawing rights with international monetary fund (IMF). (Romero, 2005). However, it is pertinent to note that for there to be a reserve there must have been growth powered by the proper utilization of money supply leading to higher productivity that can sustain a country's import and debt servicing ability.

Foreign reserves over the years have been a critical economic factor for any economy's development; and this is not different in Nigeria, as the accumulation of foreign reserves experienced an upward trend except in 2003, amidst decaying infrastructure. (Oputa and Ogunleye 2010).

The need to accumulate foreign reserves is important, especially if it is to act as a precautionary motive for the absorption of external shocks. Reserves increase significantly in economies with unlimited exchange rate flexibility, as countries with flexible exchange rates are not expected to maintain a currency peg, thereby requiring fewer amounts of foreign exchange reserves.

Countries still hold reserves as an important monetary tool and a means of self-insuring against major financial crisis. Holding large sizes of foreign reserves provide a form of self-insurance against the risk of rapid withdrawal of cross-border investment which may lead to a deep recession. Heller, (1966). Although this should be capped in order to avoid the cost of holding excessive reserves. Romero, (2000). It is in the light of the above that this study explores causal links between external reserves and other vital macroeconomic variables.

2. Literature review and theoretical framework:

Foreign reserves have been an issue of serious concern for political economists over the years, with respect to their determination, adequacy and causal links. This is so, because the accumulation of international reserves by emerging countries has distorted the global balance. The fundamental issue therefore, is the proper management of foreign exchange reserves, which is an integral part of domestic monetary policy. This allows countries to establish a legal framework governing international transactions, so as to efficiently manage their foreign exchange reserves; depending on the exigencies of the time. Polterovich and Popov (2002), posit, that countries with growing foreign reserves to GDP ratios show higher capital productivity and higher growth rates, and if financed by domestic borrowings will involve opportunity or "quasi-fiscal. McCauley, (2007). Such cost according to Aizenman and Lee (2007), becomes higher in developing countries because they always have a lower level of capital and a higher level of marginal product of capital. Though a foreign reserve could be a stabilizer, but it could also be a deadwood, making Lin, (2011), to use a bivariate model (foreign reserves-economic growth) to examine the causal relations for twenty largest reserves holding countries. The result showed that foreign reserves unilaterally Granger cause economic growth only in emerging countries and not in advanced countries.

Heller and Khan (1978), Lizondo and Malhieson (1987), established a relatively stable long-run

demand for reserves, based on a limit set of explanatory variables, one of which is economic size. Aizenman and Marion (2004) investigates the interpretation of the relatively high demand for reserves by emerging countries of Asia and the relatively low demand by some other developing countries. They determined the role of political uncertainty and corruption in determining reserves holdings. They showed that sovereign risk, costly tax collection to cover fiscal liabilities and loss of overtime lead to a relatively large precautionary demand for international reserves.

Furthermore, Elhiraika and Ndikumana (2007), utilized panel data from 21 African countries, considering the sources, motivation and economic implication of reserves accumulation, while focusing on its impact utilized several macroeconomic variables. They concluded that African countries that are richly endowed with natural resources, need to adopt a more pro- growth approach to reserves management.

Theoretical Framework:

Frankel and Saravelos(2010), considered international reserves holdings as a function of scaled variables, propensity to import, and variability measure, as well as the introduction and marginal cost for adjustments.

Again Frenkel and Jovanovic(1981) explained that the marginal propensity to import (MPI) measures an economy’s openness to external shocks and therefore would be positively related to foreign reserves, if they were held as precautionary measures.

The precautionary theory of international reserve demand, which states that reserves are held as a self-insurance against financial crisis emerged therefrom. It drew directly from the Buffer stock theory, which argued that reserves are financial stocks accumulated in times of abundance and deflated in times of scarcity. This is also supported by Jeane and Rancieve (2006), Mandoza (2004), extended the precautionary measure, while Rattan (1982) considered the intervention model.

Furthermore, Greenspan (1999), also showed that short term debt is not correlated with reserves. However, considering Oputa and Ogunleye (2010), the integrated model is adopted for this study.

3. Methodology

This study used annual data from various issues of the Central Bank of Nigeria Statistical Bulletin covering the period 1980 to 2014. The major variables for the study are Foreign Reserves, GDP,IMP,M₂ ,PDS and PS.

Specifically we have; RES f (GDP, IMP M₂, PDS, PS)

Where,

RES = External Reserve

GDP= Gross Domestic Product

IMP= Import

M₂ = Money Supply

PDS = Public Debt Service

PS = Policy Shift

Time series properties of the above variables will be examined using the Augmented Dickey Fuller (ADF (1986)), unit root test to investigate the order of integration of the variables in the model. The long run co-integration test based on Johansen (1991) co-integration procedure; followed by the vector error correction model (VECM).

$$\Delta y_t = \delta_0 + \sum_{i=1}^n \delta \Delta y_{t-1} + \alpha \beta' Y_{t-n} + e_t \dots\dots\dots(1)$$

The regression takes the form; Where Δ is the first difference operator, Y_t represents (RES,GDP,IMP,M₂,PDS and PS), δ_0 represent the intercept, and e_t represent the vector of the white noise process. The matrix β consist of r ($r \leq n-1$) co-integrating vectors. Matrix α contains the error parameters. The null hypothesis will be rejected if the matrix ($\pi = \alpha\beta'$) has full rank. The stationarity of the time series data takes the following form; $\Delta y_t = \beta_1 + \beta_2 t + \delta y_{t-1} + \alpha \sum_{i=1}^m \Delta y_{t-1} + e_t \dots\dots\dots(2)$

Where e_t is the white noise error term, $\Delta y_{t-1} = (\Delta y_{t-1} - \Delta y_{t-2})$, $\Delta y_{t-2} = (y_{t-2} - \Delta y_{t-1})$

The stationarity test determines if the estimates of δ are equal to zero or not. If the calculated t- ratio of the coefficient δ is less than t-critical value from fuller table, then y is said to be stationary. The long and short run dynamics between Foreign Reserves, GDP,IMP,M₂ ,PDS and PS.

is tested using VECM model of Sawhney, Anuruo and Feridun (2006).

$$\Delta RES_t = \alpha + \sum_{i=1}^a \phi_i \Delta RES_{t-1} + \sum_{i=1}^b \phi_i \Delta GDP_{t-1} + \sum_{i=1}^c \phi_i \Delta IMP_{t-1} + \sum_{i=1}^d \phi_i \Delta M_2_{t-1} + \sum_{i=1}^e \phi_i \Delta PDS_{t-1} + \sum_{i=1}^f \phi_i \Delta PS_{t-1} + \phi_i \mu_t \dots\dots\dots(3)$$

$$\Delta GDP_t = \alpha + \sum_{i=1}^a \phi_i \Delta RES_{t-1} + \sum_{i=1}^b \phi_i \Delta GDP_{t-1} + \sum_{i=1}^c \phi_i \Delta IMP_{t-1} + \sum_{i=1}^d \phi_i \Delta M_2_{t-1} + \sum_{i=1}^e \phi_i \Delta PDS_{t-1} + \sum_{i=1}^f \phi_i \Delta PS_{t-1} + \phi_i \mu_t \dots\dots\dots(4)$$

$$\Delta IMP_t = \alpha + \sum_{i=1}^a \phi_i \Delta RES_{t-1} + \sum_{i=1}^b \phi_i \Delta GDP_{t-1} + \sum_{i=1}^c \phi_i \Delta IMP_{t-1} + \sum_{i=1}^d \phi_i \Delta M_2_{t-1} + \sum_{i=1}^e \phi_i \Delta PDS_{t-1} + \sum_{i=1}^f \phi_i \Delta PS_{t-1} + \phi_i \mu_{t-1} \quad (5)$$

$$\Delta M_2_t = \alpha + \sum_{i=1}^a \phi_i \Delta RES_{t-1} + \sum_{i=1}^b \phi_i \Delta GDP_{t-1} + \sum_{i=1}^c \phi_i \Delta IMP_{t-1} + \sum_{i=1}^d \phi_i \Delta M_2_{t-1} + \sum_{i=1}^e \phi_i \Delta PDS_{t-1} + \sum_{i=1}^f \phi_i \Delta PS_{t-1} + \phi_i \mu_{t-1} \quad (6)$$

$$\Delta PDS_t = \alpha + \sum_{i=1}^a \phi_i \Delta RES_{t-1} + \sum_{i=1}^b \phi_i \Delta GDP_{t-1} + \sum_{i=1}^c \phi_i \Delta IMP_{t-1} + \sum_{i=1}^d \phi_i \Delta M_2_{t-1} + \sum_{i=1}^e \phi_i \Delta PDS_{t-1} + \sum_{i=1}^f \phi_i \Delta PS_{t-1} + \phi_i \mu_{t-1} \quad (7)$$

$$\Delta PS_t = \alpha + \sum_{i=1}^a \phi_i \Delta RES_{t-1} + \sum_{i=1}^b \phi_i \Delta GDP_{t-1} + \sum_{i=1}^c \phi_i \Delta IMP_{t-1} + \sum_{i=1}^d \phi_i \Delta M_2_{t-1} + \sum_{i=1}^e \phi_i \Delta PDS_{t-1} + \sum_{i=1}^f \phi_i \Delta PS_{t-1} + \phi_i \mu_{t-1} \quad (8)$$

Where Δ , stands for difference operator, and others as stated above. The lag lengths are automatically determined by the modified AIC and are represented by a, b, c, d, e and f. μ_{t-1} is the error term lagged one period. The error correction term assess the deviation of the variables from the long run equilibrium association. The null hypothesis of non-causality will be rejected if sum of the regression co-efficient of the dependent variable is significantly different from zero.

4. Empirical Result

4.1 TABLE1: SUMMARY OF OLS RESULT: Dependent variable LNRES

Variable	Coefficient	Std. Error	t-Statistic	Prob.
LNGDP	1.108492	0.411760	2.692084	0.0118
LNIMP	0.212736	0.180134	1.180992	0.2475
LN M_2	-0.684533	0.450850	-1.518317	0.1401
PS2	1.302103	0.402109	3.238181	0.0031
LNPDS	-0.395350	0.154559	-2.557929	0.0162
C	9.578960	3.388581	2.826835	0.0086

$R^2=87\%$, Adj. $R^2 = 85\%$, D.W= 1.3, F-statistic = 39.13275, Prob F(0.000000)

The result showed a high level of relationship between the dependent variable and independent variables ($R^2=87\%$). The F - statistic (39.13275) showed that the entire model is strong. Economic Growth, Public Debt Servicing and Policy shift significantly affected economic performance and they appeared with their correct signs. The result showed that a 10% change in economic growth will lead to a 110% increase in foreign reserves, while a 1% increase in foreign reserves, will cause a 39% reduction in public debt.

4.2 Stationarity Test

The result of the unit root test performed on all the variables (6) in the model, using Augmented Dickney-Fuller (ADF), revealed that four of the variables were stationary at 1st difference, and the remaining two at 2nd difference. According to Razak(2007), at first differencing , a time series that has one unit root and another that has a double unit root can still be integrated, where the resulting linear combination is 1(1). If this is true, the OLS estimator of the regression in the levels is consistent. Therefore, it is evident from our result that the null hypothesis of the presence of unit root in the series is rejected

Table2: Stationarity (UNIT ROOT) test result.

VARIABLES	ADF critical statistic @ 5%	Remarks
	2.9558	
LNRES	-4.9412	1 (1)
LNGDP	-7.029016	1(2)
LNIMP	-5.123434	1(1)
LN M_2	-4.495864	1(2)
PS2	-4.000000	1(1)
LNPDS	-4.942842	1(1)

4.3 Pairwise Granger Causality Test

Moving forward, the study went on to establish the direction of causality between Foreign Reserves, GDP,IMP, M_2 ,PDS and PS., having passed the stationarity test. The Granger test was conducted with a lag length of 2 and 5 percent level of significance. The result, as shown on the appendix indicates that there exist an interdependent bi-directional causality between foreign reserves and economic growth, as well as between import and economic growth. However, a unidirectional causality exist between import and foreign reserves, as well as money supply and foreign reserves, with import and money supply Granger causing foreign reserves. Showing that and increase in economic growth will cause foreign reserves to improve within the period.

4.4 Co-integration Test and Result.

Table3: Johansen Co-integration Test

Eigenvalue	Likelihood Ratio	5 Percent Critical Value	1 Percent Critical Value	Hypothesized No. of CE(s)
0.720276	122.0068	94.15	103.18	None **
0.644048	81.24037	68.52	76.07	At most 1 **
0.544788	48.18569	47.21	54.46	At most 2 *
0.393346	23.00196	29.68	35.65	At most 3
0.182169	7.008443	15.41	20.04	At most 4
0.017754	0.573242	3.76	6.65	At most 5

The result from Johansen test showed three co-integrating relationship with a lag length of one, indicating a long run relationship exist among the variables entered, at 5% significant level.

Table3b: Long- run Estimate

Regressors'	Long run estimates	Standard error	t-values
LNRES	1.000000		
LNGDP(-1)	0.607045	0.49637	1.22297
LNIMP (-1)	-1.892224	0.36325	-5.20910
LN M_2 (-1)	0.399211	0.41517	0.96155
PS2 (-1)	-1.517975	0.33159	-4.57785
LNPDS(-1)	0.895639	0.22619	3.95967
C	-12.83781		

Table3c: Short-run estimates

Error Correction	D(LNRES)	D(LNGDP)	D(LNIMP)	D(LNM2)	D(PS2)	D(LNPDS)
CointEq1	-0.365130 (0.14201) (-2.57119)	-0.113330 (0.05466) (-2.07336)	0.725549 (0.16567) (4.37951)	0.020019 (0.03210) (0.62370)	-0.078206 (0.04643) (-1.68445)	-0.021200 (0.15651) (-0.13545)
D(LNRES(-1))	0.543967 (0.26262) (2.07134)	0.184385 (0.10108) (1.82408)	-0.769076 (0.30637) (-2.51026)	0.001280 (0.05936) (0.02156)	0.160703 (0.08586) (1.87167)	-0.217044 (0.28944) (-0.74987)
D(LNGDP(-1))	0.329582 (0.56859) (0.57965)	-0.099278 (0.21886) (-0.45362)	0.302957 (0.66333) (0.45672)	-0.003431 (0.12852) (-0.02670)	-0.003198 (0.18590) (-0.01721)	-0.048040 (0.62667) (-0.07666)
D(LNIMP(-1))	-0.237760 (0.18024) (-1.31914)	-0.019314 (0.06938) (-0.27840)	0.372171 (0.21027) (1.76997)	0.020332 (0.04074) (0.49909)	-0.212029 (0.05893) (-3.59814)	0.130039 (0.19865) (0.65462)
D(LNM2(-1))	0.419598 (0.79215) (0.52969)	0.492301 (0.30491) (1.61459)	-0.107733 (0.92414) (-0.11658)	0.483008 (0.17905) (2.69768)	0.016701 (0.25899) (0.06449)	-0.544823 (0.87306) (-0.62404)
D(PS2(-1))	0.329141 (0.46658) (0.70543)	0.059478 (0.17959) (0.33118)	-0.032826 (0.54433) (-0.06031)	0.131834 (0.10546) (1.25009)	-0.052993 (0.15255) (-0.34739)	-0.612576 (0.51424) (-1.19122)
D(LNPDS(-1))	-0.136963 (0.16670) (-0.82163)	0.022123 (0.06416) (0.34479)	-0.338769 (0.19447) (-1.74201)	-0.023853 (0.03768) (-0.63309)	0.002637 (0.05450) (0.04838)	-0.289924 (0.18372) (-1.57805)
C	-0.047189 (0.19107) (-0.24697)	0.114397 (0.07354) (1.55548)	0.198482 (0.22291) (0.89043)	0.111296 (0.04319) (2.57710)	0.061332 (0.06247) (0.98179)	0.406048 (0.21059) (1.92818)

$R^2 = 33\%$, Adj. $R^2 = 14\%$, F-Statistic = 1.69 Akaike AIC = 1.44, Schwarz SC = 1.81

The results of the VECM presented in tables 3b and c, shows a poor fit, with R^2 of 33%. The result of the short run test indicates that GDP has a value of 0.329582 and a long run value of 0.607045. This suggest that a 1% improvement in GDP, will increase Foreign Reserve by 3.3%, in the short run. Whereas, in the long run, Foreign Reserves will improve by 6.1%. The result of short run value of value of import is -0.237760 with a long run value of -1.892224. This suggest that a 2.3% and 18% reduction on import will lead to a 1% improvement on Foreign Reserve in the short and long run periods respectively.

However, the error correction coefficient, which is the speed with which the system will adjust to

shocks and restore equilibrium between the short and long run periods as measured by the ECM is -0.365130.

The model came with the expected sign, showing that the speed of adjustment will be fair. This is expected considering the effect of the dwindling fortune of the naira and the low patronage from foreign investors in recent time. The high cost of governance and the incessant importation of consumer goods will need to be redressed for there to be improvement in our foreign reserves.

5. Conclusion and Recommendations

The paper used the Granger Causality, Johansen test and the Vector Error Correction Model (VECM), to examine the causal direction and relationship, between foreign reserves, economic growth, value of import and debt servicing covering the period 1980 to 2014. The study ascertains that within the short and long run periods a reduction on import will greatly improve the nation's foreign reserves and economic growth will do the same; even though foreign reserves can equally improve GDP as an insurance and interventionist mechanism.

The ECM, was actually applied to in the study to avoid spurious regression phenomenon, and it actually confirmed the existence of a short and long run relationships among the variables by appearing with the correct sign and being statistically significant as well.

The study recommend the reduction of our import, especially on consumption and frivolities, for there to be an improvement on foreign reserves and by extension GDP. The Government should put up policies that will encourage foreign investment and also create a conducive environment by containing Boko Haram, kidnapping and other Vices, including corruption. Cost of Governance should be greatly reduced and Corporate Governance practices highly imbibed.

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APPENDIX

1	DATA USED FOR THE STUDY (1980-2014)					
RES	GDP	IMP	M2	PS	PS2	
1.06E+10	41974.70	14623.53	14.07000	0.000000	0.000000	
4.17E+09	49632.30	12599.10	14.47000	0.000000	0.000000	
1.93E+09	47619.70	10096.10	15.79000	0.000000	0.000000	
1.25E+09	49069.30	6551.850	17.69000	0.000000	0.000000	
1.67E+09	53107.40	4481.050	20.11000	0.000000	0.000000	
1.89E+09	59622.50	5533.030	22.30000	0.000000	0.000000	
1.35E+09	67908.60	5970.860	23.81000	0.000000	0.000000	
1.50E+09	69147.00	15645.30	27.57000	0.000000	0.000000	
9.33E+08	105222.8	17642.62	38.36000	0.000000	0.000000	
2.04E+09	139085.3	25179.17	45.90000	0.000000	0.000000	
4.13E+09	216797.5	34704.68	52.86000	0.000000	0.000000	
4.68E+09	267550.0	69981.88	75.40000	0.000000	0.000000	
1.20E+09	312139.7	152901.6	111.1100	0.000000	0.000000	
1.64E+09	532613.8	181924.1	165.3400	0.000000	0.000000	
1.65E+09	683869.2	98748.85	230.2900	0.000000	0.000000	
1.71E+09	899863.2	254701.6	289.0900	0.000000	0.000000	
4.33E+09	1933212.	375194.0	345.8500	0.000000	0.000000	
7.78E+09	2702719.	447725.2	413.2800	0.000000	0.000000	
7.30E+09	2801973.	405587.5	488.1500	0.000000	0.000000	
5.65E+09	2708431.	406961.4	628.9500	0.000000	0.000000	
1.01E+10	3194015.	591325.6	878.4600	1.000000	0.000000	
1.06E+10	4582127.	885114.1	1269.320	1.000000	0.000000	
7.57E+09	4725086.	1054076.	1505.960	1.000000	0.000000	
7.43E+09	5912381.	11923099	1952.920	1.000000	0.000000	
1.73E+10	8487032.	1575564.	2131.820	1.000000	0.000000	
2.86E+10	11411067	1779602.	2637.910	1.000000	1.000000	
4.27E+10	14572239	2922248.	3797.910	1.000000	1.000000	
5.19E+10	18564595	4127690.	5127.400	1.000000	1.000000	
5.36E+10	20657325	3299097.	8008.200	1.000000	1.000000	
4.55E+10	23842126	5480700.	9419.920	1.000000	1.000000	
3.59E+10	23852164	8154000.	11034.94	1.000000	1.000000	
3.63E+10	37409860	9892622.	12172.49	1.000000	1.000000	
4.75E+10	40544100	5624870.	13895.39	1.000000	1.000000	
4.63E+10	42396720	7015815.	15158.62	1.000000	1.000000	
3.75E+10	48140272	7374370.	16490.50	1.000000	1.000000	

Source: CBN STATISTICAL BULLETIN, VOLUME 25, 2014.

11: PAIRWISE GRANGER CAUSALITY RESULT

Null Hypothesis:	Obs	F-Statistic	Probability
LNGDP does not Granger Cause LNRES	33	6.71554	0.00415
LNRES does not Granger Cause LNGDP		5.74748	0.00810
LNIMP does not Granger Cause LNRES	33	6.26606	0.00564
LNRES does not Granger Cause LNIMP		0.06708	0.93527
LN2 does not Granger Cause LNRES	33	7.54716	0.00239
LNRES does not Granger Cause LN2		0.76251	0.47594
PS2 does not Granger Cause LNRES	33	0.51038	0.60574
LNRES does not Granger Cause PS2		3.42490	0.04671
LNPDS does not Granger Cause LNRES	32	3.98695	0.03040
LNRES does not Granger Cause LNPDS		1.54282	0.23204
LNIMP does not Granger Cause LNGDP	33	3.21159	0.05550
LNGDP does not Granger Cause LNIMP		3.79398	0.03483
LN2 does not Granger Cause LNGDP	33	2.52188	0.09839
LNGDP does not Granger Cause LN2		2.74471	0.08157
PS2 does not Granger Cause LNGDP	33	0.52637	0.59648
LNGDP does not Granger Cause PS2		1.79927	0.18402
LNPDS does not Granger Cause LNGDP	32	5.63951	0.00898
LNGDP does not Granger Cause LNPDS		0.21230	0.81006
LN2 does not Granger Cause LNIMP	33	3.92772	0.03136
LNIMP does not Granger Cause LN2		0.38116	0.68656
PS2 does not Granger Cause LNIMP	33	0.12225	0.88540
LNIMP does not Granger Cause PS2		16.1599	2.2E-05
LNPDS does not Granger Cause LNIMP	32	6.07117	0.00665
LNIMP does not Granger Cause LNPDS		1.09126	0.35015
PS2 does not Granger Cause LN2	33	1.61998	0.21591
LN2 does not Granger Cause PS2		3.47621	0.04483
LNPDS does not Granger Cause LN2	32	1.83297	0.17929
LN2 does not Granger Cause LNPDS		0.40587	0.67039
LNPDS does not Granger Cause PS2	32	1.80881	0.18315
PS2 does not Granger Cause LNPDS		0.82826	0.44761