

EXTERNAL RESERVES ON ECONOMIC GROWTH IN NIGERIA

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Abstracts

This study examined relationship between external reserves and economic growth in Nigeria from 1981 to 2014. The study used the Ordinary least squares econometric method of analysis. The result of the study showed that external reserves had positive and significant influence on the economic growth in Nigeria. Based on the major finding of this study, it was concluded that external reserve in Nigeria has over the period of study contributed positively and significantly to the growth of the economy. Thus, the study recommended the need for prudent management of Nigerian's external reserves to ensure more growth and also that government should put in more policies that will enhance increased accumulation of external reserves.

Research paper

Keywords: External reserves, economic growth, OLS, Nigeria

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Introduction

The rationale for maintaining external reserves has varied amongst countries of the world. According to the International Monetary Fund (IMF) foreign reserve is maintained for financing balance of payment disequilibrium and maintaining competitive exchange rate level capable of achieving macro-economic objectives. In addition, external reserve acts: as a monetary policy instrument; as a liquidity buffer in case of an international financial market crash; as an instrument of easing the vulnerability to external factors and boosting the stability and confidence in financial markets during periods of financial crisis. Despite the positive influence of external reserves on the economy, reserve build-ups is not without its costs: The costs associated with reserve build-ups are in several forms: Firstly, the return on foreign exchange reserve is generally much lower than return on domestic assets for the developing and emerging economies. For example, in many developing countries the return on foreign exchange reserves is less than 1.0%. This is partly because foreign reserves of central banks must be highly liquid to be qualified as reserves. This liquidity consideration essentially means the foreign reserves need to be invested in US treasury bills, and in Euro or Japanese Yen denominated government assets. In all such cases, the rate of return on foreign reserves is extremely low and the differential between the return on domestic assets and the lower return of foreign assets constitute a significant income loss for the central bank. This is particularly large in the current low interest rate environment in the industrial countries (Mansur, 2013).

Secondly, a rapid foreign reserve build-up complicates monetary management for the central bank. When reserves accumulate at a faster pace

than envisaged under the monetary program, both reserve money and broad money have the tendency of exceeding their targeted rate. This situation creates tensions in monetary management and potentially undermines the inflationary target of the central bank and the government. Finally, if the central bank intervenes in the money market to sterilize the excess liquidity by issuing treasury bills or central bank bonds, it will culminate in significant quasi fiscal costs and reduced central bank profit (Mansur, 2013).

In spite of the associated cost of accumulating foreign reserves, most countries (Nigeria inclusive) of the world have accumulated foreign reserves and such accumulation of foreign reserves over the past decades has led to agitation among researchers, commentators and development planners on the implication of such reserves on the growth of an economy. With respect to Nigeria, available data from the Central bank of Nigeria Statistical bulletin 2014 edition revealed that over the past decades, the pattern/trend of foreign reserve has been characterized with ups and downs. For instance, the volume of external reserve was \$2441.60m in 1981, and declined to \$224.40m in 1983. It rose to \$7504.59m in 1987 and declined again to \$1429.59m in 1993. In 2002, the volume of foreign reserve was \$10267.10m but decline to \$7467.78m in 2003 before increasing again to \$16955.02m in 2004. Since 2004, the volume of foreign reserve has maintained an increase to about \$53000.4m in 2008 but declined to \$32339.3m in 2011. In 2012, the volume of external reserve stood at \$43830.4m but declined to \$34241.5 in 2014.

The implication of foreign reserve accumulation on economic growth has therefore been a subject of academic discuss among researchers and policy analyst on which studies have been conducted especially in the

developed countries and some developing countries (Chen, 2013; Green and Torgerson, 2007; Shameen and Moon, 2005). The few studies on external reserve in Nigeria (such as Abiola and Adebayo, 2013; Alasan and sahib, 2011) did not consider the effect of external reserve on economic growth. Abiola and Adebayo (2013) only focused on the channeling of external reserve in Nigeria into alternative investment outlets while Alasan and Shaib (2011) focused on external reserve management and economic development in Nigeria. As noted above there exist a paucity of knowledge on the relationship between foreign reserve accumulation and economic growth in Nigeria. Thus, this study seeks to fill this gap in knowledge by examining the impact of external / foreign reserve on economic growth in Nigeria from 1981 to 2014.

Literature Review

The theoretical perspectives on external reserve can be viewed from two sides: precautionary and mercantilist. The precautionary approach linked foreign reserves accumulation directly to exposure of sudden stops, capital flight and volatility, whereas the mercantilist approach views foreign reserves accumulation as a residual of an industrial policy, a policy that may impose negative externalities on other trading partners (Aizenman and Lee, 2005). In addition to the above theoretical literature, some empirical literatures have examined the relationship between foreign reserves and macroeconomic variables in both developed and developing countries. Cetin (2013) investigated the relationship between external debt components, foreign exchange reserves and economic growth in China for the period 1982 to 2009. Using Ordinary Least square (OLS) technique, the study observed

that China's short term external debt, foreign exchange reserves and total external debt have significant impact on China's economic growth. According to Granger causality analysis, China's foreign exchange reserves had a unidirectional causation to China's economic growth. Impulse response analysis and variance decomposition analysis showed that China's foreign exchange reserves innovation impact on China's economic growth rates more than China's short term external debt. Also in China, Zeng (2011) examined foreign exchange reserves demand model based on Chinese government utility maximization. Using the sample data for the period 1980 to 2006 and Vector Error Correction (VEC) model, the study found that foreign exchange reserves had positive correlation with the export. The study also observed that foreign exchange reserves had positive correlation with the marginal propensity to import.

Chen (2013) examined the impact of foreign exchange reserves on currency mismatch. The results of the study showed that foreign exchange reserves have a significant and persistent effect on currency mismatch. Zafar (2011) investigated the aggregate import demand function for India using Johansen's co-integration method. The result showed evidence of a long run equilibrium relationship between real imports, real income, relative price of imports and real foreign exchange reserves. In the long run, import was found to be elastic with respect to income, and inelastic with respect to relative price and foreign reserves. In the short run, the study found a significant relationship between import, income, relative price and foreign exchange reserves. However in the short run, import is found to be inelastic with respect to all variables. The evidence suggests that depreciation may not give desirable results for the economy as far as containing the import bill is con-

cerned. The promotion of export would be a better option to take care of problem of trade deficits.

Rizvi, Naqvi, Ramzan and Rizavi (2011) analyze the economy of Pakistan during the period of 2001-2006 with reference to the probable use of reserves accumulation as a monetary tool. The result of the study showed that foreign reserves was accumulated excessively in that period and enhanced GDP's, Exports' and Imports' growth. The study also observed that foreign reserves stabilized exchange rate and reduced debt burdens and deficits. Chaudhry, Akhtar, Mahmood and Faridi (2011) examined the relationships between foreign exchange reserves and inflation in Pakistan experience since 1960. The study used the Auto Regressive Distributive Lag Model (ARDL) proposed by Pesaran et al. (2001) in order to investigate the order of co-integration between inflation and foreign exchange reserves through bound testing approach. The study also employed Ordinary Least Squares technique to determine the long run relationship. The results of the study indicated that the rise in foreign exchange reserves leads to lower the rate of inflation in Pakistan. Park and Estrada (2009) investigated whether developing Asia's foreign exchange reserves are excessive. Informal tests of reserve adequacy based on the widely used rules of thumb such as the Greenspan-Guidotti rule which indicated unambiguously the presence of sizable excess reserves. To test for excess reserves more formally, the study used panel-data econometric analysis based on Edison (2003). The finding of the study indicated the presence of large and growing excess reserves since 2002. The results of both informal and formal tests confirmed that developing Asia had excessive foreign exchange reserves.

With respect to indigenous studies, Omolade and Ngalawa (2017) examined the role of exchange rate regimes in determining the nature of relationship between monetary policy transmission mechanisms and manufacturing output growth in oil producing economies in Africa. The study focused on Libya and Nigeria because of the different exchange rate regimes practice in both oil exporting countries. The study employed structural variance decomposition approach (SVAR). The result of the study showed that oil price shocks significantly influenced the monetary policy instrument of both countries. Monetary policy instrument appeared ineffective in promoting manufacturing sector output growth in Libya that practices fixed exchange rate while the reverse was the case in Nigeria. Amassoma (2017) examined the impact of exchange rate fluctuation on economic growth in Nigeria for the period 1970 to 2013. The study employed error correction model econometric technique and the result of the study showed that exchange rate fluctuation had positive but insignificant impact on economic growth in Nigeria. The study recommended the encouragement of domestic production to stimulate the appreciation of the domestic currency and generally to promote economic growth in Nigeria.

Abiola and Adebayo (2013) examined the cost-effective propositions of the foreign reserves in Nigeria, and considered alternative investment channels. The study adopted the theory of demand for international reserves based on three motive notably transaction, precautionary and mercantilist. The results of the study observed that Nigeria foreign reserve is adequate. The study recommended the need to split foreign reserves into four portfolios. The liquidity portfolio, long-term portfolio or investment portfolio, immunization portfolio, and the petroleum fund buffer portfolio or sover-

foreign wealth fund. Irefin and Yaaba (2012) investigated the determinants of foreign reserves in Nigeria. The study used an Autoregressive Distributed Lag (ARDL) approach to run a slightly modified econometrics 'Buffer Stock Model' of Frenkel and Jovanovic (1981) to estimate the determinants of foreign reserves in Nigeria. The results of the study debunked the existence of buffer stock model for reserves accumulation and provided strong evidence in support of income as the major determinant of reserves holdings in Nigeria.

Abdu (2013) examined the relationship between foreign direct investment and economic growth in Nigeria. Employing an ordinary least squares estimation technique, the study observed a significant relationship between foreign direct investment and economic growth in Nigeria. Ajayi and Oke (2012) examined the effect of external debt burden on economic growth and development in Nigeria. The study employed the ordinary least squares regression technique and the result of the study showed that external debt burden had an adverse effect on the nation income and per capital income of the nation. Thus the study recommended that debt service obligation should not be allowed to rise than foreign exchange earnings and that the loan contracted should be invested in profitable venture, which will generate a reasonable amount of money for debt repayment.

Benigno and Fornaro (2012) analyse the relationship among reserve accumulation, growth and financial crisis. This study presented a simple model that reproduces two facts characterizing the international monetary system: i) developing countries that grow faster accumulate more international reserves and ii) fast growing developing countries are associated with lower net capital inflows. In their framework the government used foreign

exchange reserves to internalize the growth externalities present in the tradable sector and to provide liquidity to the corporate sector during periods of financial stress. Thus, this created a positive link between reserve accumulation, current account surpluses and growth. Importantly, the study observed that official reserves and private debt are imperfect substitutes, implying that the reserve policy of the government cannot be perfectly offset through borrowing by private agents. Also, the found that optimal reserve management entails a fast rate of reserve accumulation, as well as higher growth and larger current account surpluses compared to the economy with no policy intervention. The study further observed that the welfare gains of reserve policy are large.

Alasan and Shaib (2011) examined the management of external reserves and economic development in Nigeria between for the period 1980 to 2008. The result of the study revealed a significant relationship in the management of external reserves and economic development in Nigeria. Thus, the study recommended that reserve management should seek to ensure that adequate reserves are available such that risks are controlled in a prudent manner and reasonable earnings are generated over the medium to long term on the funds invested. Olokoyo, Osabuohien and Salami (2009) examined the interactive influence of foreign reserve (FRS) on some macroeconomic variables (economic size, trade, level of capital inflows, exchange rate and inflation) in Nigeria over the period 1970 to 2007. The study employed cointegration test and vector error correction (VEC) within the framework of autoregressive distributed lags (ARDL). The results of the study showed the possibility of convergence of the variables from the short run to the long run with a slow speed of adjustment. The study concluded that accumulation of

large foreign reserves is not very productive in Nigeria due to its inability to induce some of the macroeconomic variables. From the existing reviewed literature, it is observed that there is paucity of knowledge on the relationship between external reserves and economic growth in Nigeria, thus justifying the need for this study. Also, there have been continuous debates on the utilization of the foreign reserve for investment purposes particularly in the face of declining global crude oil price and the intense drive at diversifying the Nigerian economy rather than just accumulating foreign reserves. Thus, the findings of this study will equip policymakers on appropriate management of foreign reserves in Nigeria.

Research Methodology

Theoretical Framework/Model Specification

Following studies by Oteng-Abayie and Frimpong (2006) and Herzer, Nowak-Lehmann and Siliverstovs (2006), this study employed the neo-classical growth model to examine the relationship between economic growth and foreign exchange reserves in Nigeria. This model is represented in a Cobb-Douglas production function as:

$$Y_t = A_t K_t^\alpha L_t^\beta \dots\dots\dots (1)$$

where Y_t denotes the aggregate production of the economy (real GDP) at time t and A_t , K_t , and L_t are the total factor productivity (TFP), the capital stock and the stock of labour, respectively. Incorporating external reserve (RESV) and exchange rate (EXT) into equation (1) becomes:

$$Y_t = A_t K_t^\alpha L_t^\beta RESV_t^\chi, EXT_t^\psi \dots\dots\dots (2)$$

From equation (2), an explicit estimable production function in log form (taken into consideration external reserve (RESV) and exchange rate

(EXT) and assuming is $A_t = \alpha_0; \alpha = \alpha_1; \beta = \alpha_2; \chi = \alpha_3; \psi = \alpha_4; K = \text{GFCF}$ and $L = \text{LAB}$) is specified as:

$$\ln Y_t = \alpha_0 + \alpha_1 \ln \text{GFCF}_t + \alpha_2 \ln \text{LAB}_t + \alpha_3 \ln \text{RESV}_t + \alpha_4 \text{EXT}_t + \varepsilon_t \dots\dots (3)$$

where α_0 is the constant parameter and ε_t is the error term. Theoretically, $\alpha_1, \alpha_2, \alpha_3$ and α_4 , are expected to have positive effect on economic growth. Alternatively, the a priori expectation can be stated as $\alpha_1 > 0; \alpha_2 > 0; \alpha_3 > 0$ and $\alpha_4 > 0$.

Measurement of Variables

Economic growth (Y) is measured by real gross domestic product; capital stock (GFCF) is measured by gross fixed capital formation; labour force (LAB) is measured by the working population or total number of the labour force; external reserve (RESV) is measured by the annual volume of external reserve; and exchange rate is measured by the official ₦/\$ exchange rate. Data on economic growth (Y), capital stock, labour force, external reserve and exchange rate are obtained from the Central Bank of Nigerian (CBN) statistical bulletin, 2015 edition.

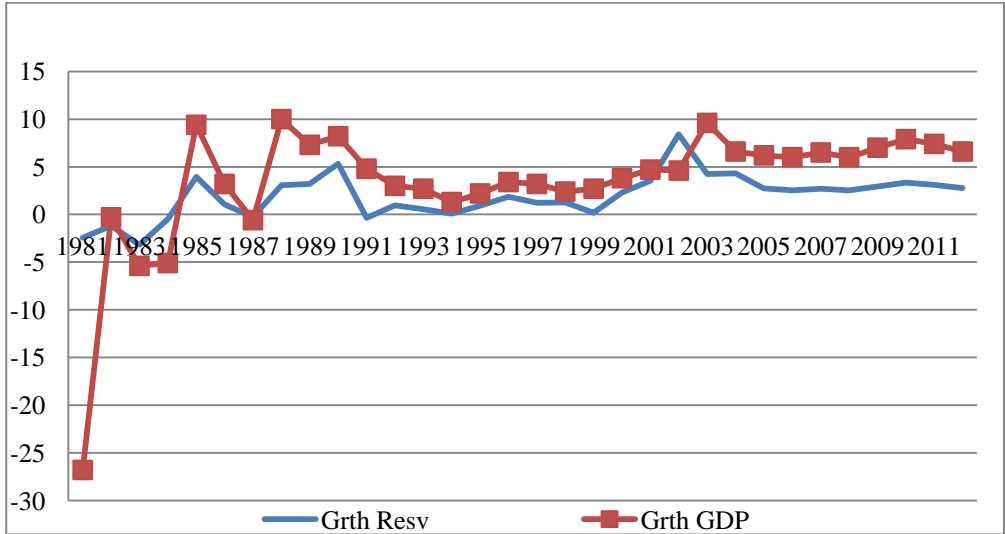
Data Analysis and Interpretation

This section presents the trend and empirical analysis of the relationship between external reserves and economic growth in Nigeria for the period 1981 to 2014. A descriptive trend analysis of the growth rates of economic growth and external reserves in Nigeria is shown in figure 1. External reserve experienced a negative growth rate of -2.5 percent in 1980 and increased to -3.2 percent in 1983. In 1985, external reserve grew at 3.9 percent but declined to -0.2 percent in 1987 and rose again to 5.3 percent in 1990. In

1991, the growth of external reserve was -0.4 percent but in 2000 external reserve grew at 2.3 percent and rose to 8.4 percent in 2002. The growth rate of external reserve declined from 8.4 percent in 2002 to 2.9 percent in 2009 before increasing to 3.3 percent in 2010 and declining again to 2.8 percent in 2012. With respect to growth rate of the Nigerian economy, the graph shown that gross domestic product grew at a negative value of -26.8 percent in 1980. The negative growth experienced from 1980 to 1984 was reversed in 1985 as the economy witnessed an impressive growth of 9.4 percent. The growth experienced in 1985 declined to -0.6 percent in 1987 before peaking at 10 percent in 1988. As shown on the graph the, the economy witnessed a declined growth from 10 percent in 1988 to 1.3 percent in 1994 before rising again to 9.6 percent in 2003. Although the economy experienced a declined growth rate from 9.6 percent in 2003 to 6.6 percent in 2004, since 2004 to 2014 the Nigeria economy has witnessed an average impressive growth rate of 6.5 percent.

A glance at the trends of growth rates in economic growth and external reserve showed that the two variables (economic growth and external reserve) move together for most of the period under study. Particular, the study showed the growth in external reserve moved closely with the growth in economic growth in Nigeria, suggesting the growth in the economy might have influenced the growth in external reserve. However, the empirical relationship between external reserves and economic growth will be further substantiated with the analysis of the ordinary least square regression technique.

Figure 1. Trend of growth rates of economic growth and external reserves
1981 to 2014



Source: Authors, 2016

The regression estimate on the effect of external reserves (RESV) on economic growth with exchange rate (EXT), capital stock (GFCF) and labour force (LAB) as explanatory variables is presented in table 1 below. All variables in the regression mode were log with exception to exchange rate. From table it is observed that the explanatory power of the model (that is, R-squared) is 0.96, indicating that about 96 percent of the variation in economic growth within the study period is explained jointly by the explanatory variables. The coefficient of the exchange rate was positive (0.002) and significant ($p < 0.05$) suggesting that a one percent increase in exchange rate will result in a 0.2 percent increase in economic growth. This implies that exchange rate appreciation will promote economic growth. Also, the coefficient of the capital stock was positive (0.168) and significant ($p < 0.05$) suggesting that a one percent increase in capital stock will promote economic

growth by 16.8 percent. In contrast to the positive impacts of exchange and capital stock in economic growth in Nigeria, the study found that labour force had a negative (-0.25) but insignificant ($p > 0.05$) on economic growth in Nigeria. This result showed that population growth has not enhanced economic growth but rather constitute an impediment to the growth of the country. Finally, the findings of the study showed that external reserve had a positive (0.06) and significant ($p < 0.05$) effect on economic growth in Nigeria.

With respect to the focus of study, the regression estimate showed that accumulation of external reserves in Nigeria over the period 1981 to 2014 has been positively utilized leading to an increase in economic growth in Nigeria. This could result from the maintenance of stable exchange rate which has contributed to influencing the economy positively. This finding is consistent with Cetin (2013), Benigno and Fornaro (2012) and Alasan and Shaib (2011)

Table 1. Regression Estimate on External Reserve and Economic Growth

Variable	Coefficient	Std. Error	t-Statistic	Prob.
EXT	0.002196	0.000929	2.362849	0.0256
LGFCF	0.168300	0.061152	2.752147	0.0105
LLAB	-0.254814	0.596708	-0.427033	0.6727
LRESV	0.064780	0.028228	2.294874	0.0297
C	14.44547	9.599614	1.504797	0.1440
R-squared	0.960331	Mean dependent var		12.75182
Adjusted R-squared	0.954454	S.D. dependent var		0.491558
S.E. of regression	0.104906	Akaike info criterion		-1.528907
Sum squared resid	0.297141	Schwarz criterion		-1.299886
Log likelihood	29.46251	F-statistic		163.4076
Durbin-Watson stat	1.757664	Prob(F-statistic)		0.000000

Source: Authors' using E-views 7, 2016

Conclusion and Policy Recommendations

The main focus of this study is to fill the gap in knowledge on the relationship between external reserve and economic growth in Nigeria from 1981 to 2014. It is expected that external reserves would have a positive impact on the economic growth in Nigeria. This study employed econometric tools to analyze time series data sourced from CBN Statistical Bulletin (1981–2014) after providing the theoretical background on the relationship between foreign reserves and economic growth. In line with theoretical expectation, the study observed that external reserves had a positive-significant effect on the economic growth in Nigeria. This finding is consistent with Cetin (2013), Benigno and Fornaro (2012) and Alasan and Shaib (2011) but contrary to Olokoyo, Osabuohien and Salami (2009). Based the findings the study concluded that external reserve in Nigeria has over the period of study contributed positively and significantly to the growth of the economy. The positive impact of economic growth by external reserves could result from the exchange rate stability and the boosting of foreign investors' confidence on the Nigeria economy which may have enhanced the inflow of such foreign capital in Nigeria. Therefore, the study suggests the need for prudent management of the Nigerian external reserves to ensure more growth. Secondly, the study suggests that government should put in place policies that will enhance increased accumulation of external reserves. Thirdly and finally, the study suggest the need for government to put in place appropriate legal policies and framework that would prevent corrupt individuals from embezzling accumulated reserves which can negatively affect the growth of the Nigerian economy.

References

1. Abdu, M. (2013). Foreign direct investment and economic growth in Nigeria. *International Journal of Arts & Sciences*, 6(1), 63-72.
2. Abiola, A.G. & Adebayo, F.O. (2013). Channeling the Nigeria's Foreign Exchange Reserves into Alternative Investment Outlets: A Critical Analysis, *International Journal of Economics and Financial Issues*, 3(4), 813-826.
3. Aizenman, J. & Lee, J. (2005). *International Reserves: Precautionary versus Mercantilist Views, Theory and Evidence*, International Monetary Fund, Washington, DC, IMF Working Paper 05/198.
4. Alasan, A.B. & Shaib, I.O. (2011). External Reserves Management and Economic Development in Nigeria (1980-2008). *European Journal of Business and Management*, 3(11), 1-9.
5. Amassoma, D. (2016). The Nexus between Exchange Rate Variation and Economic Growth in Nigeria. *Journal of Entrepreneurship, Business and Economics*, 5(1), 1-40.
6. Benigno, G. & Fornaro, L. (2012). *Reserve accumulation, growth and financial crises*, CEP Discussion Papers dp1161, Centre for Economic Performance, LSE, August.
7. Boboye, L. & Ojo, M. (2012). Effect of external debt on economic growth and development of Nigeria. *International Journal of Business and Social Science*, 3(12), 297-304.
8. Çetin, H. (2013). Time Series Analysis of China's External Debt Components, Foreign Exchange Reserves and Economic Growth Rates, *The International Journal of Social Sciences*, 13(1), 1-15.
9. Chaudhry, I.S., Zakariya, B., Akhtar, M.H., Mahmood, K. & Faridi, M.Z. (2011). Foreign Exchange Reserves and Inflation in Pakistan: Evidence from ARDL Modeling Approach, *International Journal of Economics and Finance*, 3(1), 69-76.
10. Chen, R. (2013). The Impact of China's Foreign Exchange Reserves on Currency Mismatch, *International Conference on Education and Management Science (ICETMS)*, held at Nanjing, Jiangsu, China, June 8-9, 2013.
11. Frenkel, J. A & Jovanovic, B. (1981). Optimal International Reserves, *Economic Journal*, 91, 507-514.
12. Green, R. & Torgerson, T. (2007). *Are High Foreign Exchange Reserves in Emerging Markets a Blessing or a Burden?* US Department of the Treasury Occasional Paper No. 6, Washington, DC.
13. Herzer, D., Nowak-Lehmann D.F. & Siliverstovs, B. (2006). Export-led growth in Chile: Assessing the role of export composition in productivity growth, *The Developing Economies*, 44(3), pp 306-328.

14. Irefin, D. & Yaaba, B.N. (2012). Determinants of Foreign Reserves in Nigeria: An Autoregressive Distributed Lag Approach, *CBN Journal of Applied Statistics*, 2(2), 63-82.
15. Olokoyo, F. O., Osabuohien, E.S.C. & Salami, O.A. (2009). Econometric Analysis of Foreign Reserves and Some Macroeconomic Variables in Nigeria (1970–2007), *African Development Review*, 21(3), 454-475.
16. Omolade, A. & Ngalawa, H. (2016). Monetary policy transmission mechanism and growth of the manufacturing sectors in Libya and Nigeria. *Journal of Entrepreneurship, Business and Economics*, 5(1), 67-107.
17. Oteng-Abayie, E.F. & Frimpong, J.M. (2006). Bounds Testing Approach to Co-integration: An Examination of Foreign Direct Investment Trade and Growth Relationships, *American Journal of Applied Sciences*, 3(11), 2079-2085.
18. Park, D. & Estrada, G.B. (2009). *Are Developing Asia's Foreign Exchange Reserves Excessive? An Empirical Examination*, Asian Development Bank (ADB) Economics Working Paper Series No. 170.
19. Pesaran M.H., Shin Y. & Smith R.J. (2001). Bounds testing approaches to the analysis of level relationships, *Journal of Applied Econometrics*, 16, 289-326.
20. Rizvi, S.K.A., Naqvi, B., Ramzan, M. & Rizavi, S.S. (2011). Pakistan's accumulation of foreign exchange reserves during 2001–2006: Benign or hostile, Excessive or Moderate. Intent or fluke, *Pakistan Journal commerce and Social science*, 5(1), 47-67.
21. Shameen, A. & Moon, I, (2005). Asia cannot live by T-notes alone, Business week www.businessweek.com/magazine/content/05_23/b3936141_mz035.htm.
22. Zeng, S. (2011). Foreign Exchange Reserves Demand Model Based on Chinese Government Utility Maximization and Analysis of Chinese Foreign Exchange Reserves, *Modern Economy*, 2, 354-370.