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Investigating the Relationship between Expenditure and Economic Growth in Nigeria: A Two stage Robust Autoregressive Distributed Lag Approach to Cointegration

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ABSTRACT *This study examined the relationship between government expenditure and economic growth in Nigeria using annual data from 1970-2011 collected from the Statistical Bulletin of the Central Bank of Nigeria. The analysis is based on autoregressive distributed lag cointegration (ARDL) bound test approach by Peseran and Shin (2001). ARDL bound test revealed that the variables are cointegrated. The long run estimates revealed that recurrent and capital expenditure have a positive effect on GDP and are significant. The error correction mechanism has a negative sign and is significant.*

KEYWORDS : Autoregressive Distributed Lag Model (ARDL), Two Stage Least Square, Robust, Cointegration, Unit Root Test, Error Correction

INTRODUCTION

The impact of government expenditure on the economic growth of nations is a well discussed issue among scholars. This is because the growths of economy have a direct or indirect impact on the standard of living of the citizens. Over the years in developing countries especially Nigeria, there has been a steady increase in government spending without an appreciable increase in economic growth and development. Government spending in Nigeria has continued to rise due to money realized from production and sales of crude oil, and the increased in population. This has led to more demand for infrastructural facilities like roads, communication, power, education and health. Government has also increased security funds especially in the face of increasing insurgency and other crimes in the nation.

Statistics have shown that government expenditure (capital and recurrent) have continued to rise in the last forty (40) years. For instance, total capital and recurrent expenditure increased from N10, 163.3m, N4, 805.2m in 1980 to N24, 048.6m, N36,219.6m in 1990 and further increased to N23,9450.9m, N46,1600m in 2000. Between 2001 to 2009, they had increased from N438,696.5m, N579,300m to N1,152,796.6b, N2,131,906b respectively (Taiwo and Agbatogun, 2011). Unfortunately, this rising government expenditure has not translated into meaningful growth and development, as Nigeria still ranks among the poorest countries in the world. In addition, many Nigerians have continued to wallow in abject poverty while more than 50 percent live on less than US$2 per day (Louis, 2012).

Public expenditure and national income have been at the focus of public finance since the magnitude of public expenditure has been increasing over time in almost all the countries of the world. Public expenditure on all sectors of the Nigerian economy is expected to lead to economic growth in the sense that capital and recurrent expenditure ought to boost the productive base of the economy which in turn leads to growth. However, the mismatch between the performance of Nigeria's economy and massive increase in government capital expenditure over the years raises a critical question on its role in promoting economic growth and development.

Barro (1990) endogenized government spending in a growth model and analyzed the relationship between size of government and rates of growth and saving. He concluded that an increase in resources devoted to non-productive government services is associated with lower per capita growth. Therefore, government expenditure which enhances economic growth should be tailored towards productive services. This necessitates the need to determine whether the behavior of Nigerian public expenditure and the economy can be hinged on the Wagner's (1883) Law of Ever-increasing State Activity, or the Keynes (1936) theory and Friedman (1978) or Peacock and Wiseman's (1979) hypotheses. In Nigeria, some authors contend that the link between public expenditure and economic growth is weak or non-existing while others have reported varying degree of causality relationship between them (Onakoya et al., 2012).

The main objective of this paper is to examine the impact of public expenditure on economic growth using autoregressive distributed lag model. Efforts are made to correct the various assumptions violations of classical regression model which could have led into misleading conclusions.

2.0 LITERATURE REVIEW

Ekpo (1994) examined the impact of public expenditure on economic growth from 1960 to 1992. Ighodaro and Okiakhi (2010) examined government expenditure which was disaggregated into general administration, and community and social services in Nigeria using time series data for 46 years ending 2007 and applying the Granger causality test. The results showed that government expenditure has negative impact on economic growth. Muritala and Taiwo (2011) examined the trends and effects of government spending on the growth rates of real GDP in Nigeria between 1970 and 2008 using Ordinary Least Square (OLS) technique. The findings show that there that there is a positive relationship between real GDP as against the recurrent and capital expenditure.

Fajingbesi and Odusola (1999) investigated the relationship between public expenditure and growth. The results showed that real government capital expenditure has more significant positive influence on growth than real government recurrent expenditure. Abu & Abdullahi (2010) showed that total capital expenditure, total recurrent expenditure and government expenditure on education have negative effects on economic growth. Omoke (2009) investigated the direction of causality between Government expenditure (GE) and National Income (NI) in Nigeria using annual data. He employed the co-integration

and Granger Causality tests for the period 1970-2005. His result showed that no long-run relationship existed between government expenditure and national income in Nigeria. The Granger causality test revealed that causality ran from government expenditure to national income thus concluding that government expenditure plays a significant role in promoting economic growth in Nigeria. Adefeso and Mobolaji (2010) in their research suggested that the effect of monetary policy is dominant than fiscal policy on economic growth in Nigeria. This result was arrived at having utilised annual time series data during the year 1970 to 2007 and considering GDP, broad money (M2), Government expenditures (G.E) and degree of openness (DOP) as key parameters and error correction and cointegration framework.

Modebeet al. (2012) examines the impact of capital and recurrent expenditure on Nigeria's economic growth. Multiple regression was adopted in their research. Recurrent expenditure and capital expenditure were used as independent variable and gross domestic product growth rate as dependent variable. The result from the study reveals that while recurrent government expenditure had positive and non-significant impact on economic growth, capital expenditure had negative and non-significant impact on economic growth. Ghali and Al-Shamsi (1997) examined the causal relationship between government expenditure and economic growth from 1973 to 1995 in U.A.E using a cointegration and error-correction framework. There is evidence of cointegration between government expenditure and GDP. Causality tests showed that causation runs from government expenditure to GDP. Fuente (1997) studied the impact of public expenditure and taxation on economic growth of 21 countries. Laudau (1983) studied the effect of government (consumption) expenditure on economic growth for a sample of ninety six (96) nations. His result was that there is a negative effect of government expenditure on growth of real output. Muhlis and Hakan (2003) examined the long-run relationship between public expenditure and GDP in the Turkish economy from 1965-2000. Co-integration and Granger Causality tests were statistical tests adopted. Mwafaq (2011) examined the impact of public expenditures on economic growth of Jordan for the period 1990-2006 and found that the government expenditure at the aggregate level has positive impact on the growth of GDP which is tune with the Keynesian's theory. LiuChih-Hunget al. (2008) investigated the causal link between GDP and public expenditures for US federal government covering the time series data 1974-2002. It was discovered that total expenditure causes the growth of GDP. This is consistent with the Keynesian theory. However, the growth of GDP does not cause the increase in total public expenditure which is inconsistent with Wagner's law.

3.0 METHODOLOGY

This study focuses on the impact of capital and recurrent expenditure on Nigerian economic growth. Data were extracted on Government Expenditure and Gross Domestic Product from

1981 to 2011 from CBN Statistical bulletin. An econometric model for this study is specified as follows:

$$lrgdp_t = \beta_0+\beta_1 lcexp_t + \beta_2 lrcexp_t + \epsilon_t,\ t=1, 2, \ldots, 42 \quad (1)$$

where

$lrgdp_t$ = Natural Logarithm of Gross Domestic Product in year t.

$lcexp_t$ = Natural Logarithm of Capital Expenditure in year t.

$lrcexp_t$ = Natural Logarithm of Recurrent Expenditure in year t.

ϵ_t = Error term associated with time t.

β_0, β_1,β_2 are the regression coefficients.

3.1 AUGMENTED DICKEY-FULLER (ADF) TEST

The efficacy of statistical tests on a times series regression model in establishing the relationship among variables is conditional on the assumption that the variables are stationary. Therefore, before fitting a regression model, the variables must be stationary. In the case of non stationary time series, it implies that the variable may be co-integrated. Dickey Fuller test is in the list of the available statistic for testing unit root (Gujarati, 2003). Mohammed (2008) suggested cointegration when the dependent and independent variable are non stationary. Peseran and Shin (2001) suggested the use of ARDL bound cointegration test when there is a mixture of both stationary and non stationary variables.

3.2 ARDL BOUND COINTEGARTION TEST

This test was developed by Peseran and Shin (1999). It is used when all the variables are integrated of the same order. It is also used when we have a mixture of stationary and non stationary variables. It is a suitable test for small sample estimation.

ARDL approach involves estimating the unrestricted error correction model as given below:

$$\Delta lrgdp_t = \sum_{i=1}^{p} a_i \Delta\, lrgdp_{t-i} + \sum_{i=0}^{q} \alpha_2 \Delta\, lrcexp_{t-i} + \sum_{i=0}^{r} \alpha_3 \Delta lcexp_{t-i} + \theta_1 lrgdp_{t-1} + \theta_2 lrcexp_{t-1} + \theta_3 lcexp_{t-1} + \delta\varepsilon_{t-1} + u_t \quad (2)$$

Δ is the first difference operator. Equation (1) is ARDL of order (p, q, r). α_1,α_2 and $\alpha_3$are the short run coefficients, θ_1, θ_2 and θ_3 are the long run coefficients and δ is the speed of adjustment.

H_0: $\theta_1 = \theta_2 = \theta_3$

The rejection of the null hypothesis is tested against the critical value in Peseran and Shin (1999). Therefore, if the computed F-statistic is smaller than the lower bound value, then the null hypothesis of no cointegration is not rejected. If the computed F-statistic is greater than the upper bound value, then the null hypothesis of no cointegration is rejected. The optimum lag in the model is selected using Schwarz Bayesian Criteria (SBIC). Diagnostic checks were performed on the model to examine the serial correlation, functional form, heteroscedasticty and multicollinearity. The stability tests are carried out using CUSUM and CUSUMSQ of recursive residuals.

3.3 Two Stage Robust Estimator

Due to the violations in the assumptions of autocorrelation, multicollinearity and heteroscedaticity in the long run regression. We apply a Two Stage Regression (TR) with robust standard error to handle the three problems simultaneously. A new data set was obtained through the transformation and the model stated below:

$$lrgdptr_t = \beta_0+\beta_1 lcexptr_t + \beta_2 lrcexptr_t + u_t,\ t=1, 2, \ldots, 42 \quad (3)$$

Two Stage Regression approach used by Hussein et al (2012) was adopted to transform the data. This was to handle the problem of autocorrelated error. The problem of multicollinearity was handled after the transformation since we have a moderate form of multicollinearity in the data. A robust standard error is then used to address the problem of heteroscedasticity.

The procedure is as follows:
Consider the Linear regression model:

$$Y=X\beta+u_t \quad (4)$$

X is an n×p matrix with full rank, Y is a n×1 vector of dependent variable, β is a p×1 vector of unknown parameters, and ϵ is the error term such that E(ϵ)=0 and E(ϵϵ^')=σ^2 I and assume that the error term follows the AR(1) scheme, namely,

u_t=ρu_{t-1}+t-1<ρ<1 (5)

ϵ_t is a white noise error term such that ϵ_t~N(0,σ^2 I)

Premultiply equation (21) by P we obtain:

$\eta_1 \{a \quad b \quad a_1 \quad b_1 \quad aa_1 \quad ab_1 \quad a_1b \quad bb_1\}$

$$E(T^2) = \frac{2}{(\lambda q)^2}$$

$$\left\{\frac{\eta_1}{(a)^2} + \frac{q_1}{(b)^2} + \frac{pp_2}{(\overline{a_1})^2} + \frac{pq_2}{(\overline{b_1})^2} - \frac{pp_1p_2}{(\overline{aa_1})^2} - \frac{pp_1q_2}{(\overline{ab_1})^2} - \frac{pp_2q_1}{(\overline{a_1b})^2} - \frac{pq_1q_2}{(\overline{bb_1})^2}\right\} \tag{16}$$

$$V(T) = E(T^2) - [E(T)]^2 \tag{17}$$

here $\overline{a}$,$\overline{b}$, $\overline{a_1}$, $\overline{b_1}$, $\overline{aa_1}$, $\overline{a_1b}$, $\overline{ab_1}$, $\overline{bb_1}$ *are* given by (15).

ıns. (16) & (17) give the mean and variance the time to recruitment for case (iii).

ote:

When p=0, our results for cases (i), (ii) (iii) agree with results in [16] for the anpower system having only one threshold hich is the mandatory threshold.

) When q=1, our results for cases (i),(ii) (iii) agree with results in [15] for the anpower system with two thresholds having ly the decision epochs.

umerical Illustrations:

ıe mean and variance of time to recruitment r the cases(i),(ii) and (iii) are numerically ustrated by varying the three nodal rameters λ, α and p one at a time. The effect variance is shown in the following table.

Effect of nodal parameters λ , α and p on performance measures

$(\theta_1 = 0.06,\ \theta_2 = 0.003,\ q = 0.4; \theta_3 = 0.$
$\theta_4 = 0.012, \theta_5 = 0.0042,\ \theta_6 = 0.009,$
$\mu_1 = 0.012,\ \mu_2 = 0.0092)$

Table 1:

λ	α	p	Case(i)	
			E(T)	V(T)
0.1	0.05	0.5	244.7823	1.3744x1
0.125	0.05	0.5	195.8258	0.8796 x1
0.1667	0.05	0.5	146.8694	0.4948 x1
0.25	0.05	0.5	97.9129	0.2199 x1
0.2	0.05	0.5	122.3911	0.3436 x1
0.2	0.0667	0.5	158.9358	0.5976 x1
0.2	0.1	0.5	232.0216	1.3156 x1
0.2	0.2	0.5	451.2715	5.1499x1
0.2	0.05	0.2	62.7065	1.6434 x1
0.2	0.05	0.3	89.2330	2.5280 x1
0.2	0.05	0.4	102.4962	2.9176 x1
0.2	0.05	0.5	122.3911	3.4359 x1

Table 2:

λ	α	p	Case(ii)	
			E(T)	V(T)
0.1	0.05	0.5	505.3928	1.4024×10^5

.25	0.05	0.5	202.1571	0.2244 x10
0.2	0.05	0.5	252.6964	0.3506×10^5
0.2	0.0667	0.5	326.4827	0.6372×10^5
0.2	0.1	0.5	474.0608	1.4641×10^5
0.2	0.2	0.5	916.8076	5.9739×10^5
0.2	0.05	0.2	128.5403	2.4304×10^4
0.2	0.05	0.3	183.7208	3.2891×10^4
0.2	0.05	0.4	211.3110	3.4901×10^4
0.2	0.05	0.5	252.6964	3.5061×10^4

Table 3:

λ	α	p	Case(iii)	
			E(T)	V(T)
0.1	0.05	0.5	206.6691	3.1147×10^4
.125	0.05	0.5	165.3353	1.9934×10^4
1667	0.05	0.5	124.0015	1.1213×10^4
.25	0.05	0.5	82.6676	0.4984×10^4
0.2	0.05	0.5	103.3346	0.7787×10^4
0.2	0.0667	0.5	133.1239	1.2725×10^4
0.2	0.1	0.5	192.6751	2.6205×10^4
0.2	0.2	0.5	371.2709	9.5486×10^4
0.2	0.05	0.2	86.3338	6.2918×10^3
0.2	0.05	0.3	93.8897	7.0276×10^3
0.2	0.05	0.4	97.6676	7.3527×10^3
0.2	0.05	0.5	103.3346	7.7869×10^3

ndings:

om the above table, the following servations are presented which agree with ality.

other parameters fixed, the mean and variance of time to recruitment decreases for all the three cases. Infact, increase in λ implies that decisions are taken frequently on the average and consequently, the time to recruitment is shortened.

2. When α increases and keeping all the other parameters fixed, the mean and variance of time to recruitment increases for all the three cases. Infact, decrease in α increases the loss of manpower on the average which inturn prepone the time to recruitment.
3. As p increases, the mean and variance of time to recruitment increases for all the three cases when the other parameters are fixed.

Conclusion:

The models discussed in this paper are found to be more realistic and new in the context of considering (i) separate points (exit points) on the time axis for attrition, thereby removing a severe limitation on instantaneous attrition at decision epochs and (ii) associating a probability for any decision to have exit points. From the organization's point of view, our models are more suitable than the corresponding models with instantaneous attrition at decision epochs, as the provision of

coefficient is computed. The result in table 3 shows that the recurrent expenditure has a negative effect on gdp and is not significant. Capital expenditure has a positive effect on gdp and is significant. The diagnostic check shows that the residuals are normally distributed using Jarque-Bera test (0.5362 > 0.05). Also, the condition of constant variance is not satisfied at 10% using Breusch-Pagan test (0.0872 > 0.05). Also, the results reveal the existence of both multicollinearity (VIF>10) and autocorrelation (DW P-value= 0.0000) simultaneously. The problem of multicollinearity might be the reason for the wrong sign in recurrent expenditure. Table 4 gives the estimates of how these problems are handled sequentially. The estimate shows that the problem of autocorrelation and multicollinearity (DW P-value=0.5057 and VIF=3.837) were corrected after data transformation. Due to the problem of heteroscedasticity, we used a robust standard error. After correcting the violations, both recurrent and capital expenditure have a positive effect on gdp and are significant. The residual obtained from Table 4 after correcting the violations is used to tie the ARDL model to obtain the short run regression in Table 5. The ARDL (1, 0, 0) is used based on the SBIC. The diagnostic tests of the short run regression are also provided in the table. The error correction mechanism has a negative sign (-1.1432) as expected and is significant (P-value=0.0000). This implies a high speed of adjustment to equilibrium after a shock. Recurrent and capital expenditures have a positive effect on Gdp and is significant.

Figure 1 and 2 provides test for the stability of the model. Figure 1 revealed that CUSUM is not completely stable within 5% of critical bands while CUSUMSQ establishes the stability of the model. Ramsey test (P-value=0.0953) shows that a correct functional form is used. The Breusch pagan test for both Heteroscedasticty (P-value=0.3319) and autocorrelation (P-value=0.1677) shows that both problems did not exists. Jarque-Bera test (P-value=0.3278) revealed that the error term is normally distributed.

4.1. UNIT ROOT TEST

Table 1: Augmented Dickey Fuller Test

Variable Status	Variable Name	Variable	Statistics	Intercept	Intercept and trend	Without intercept	lag
Original	Gross domestic Product	LnY	Value P-value	1.9745 0.9997	-1.5152 0.8016	4.2084 1.0000	0
	Capital expenditure	LnX_1	Value P-value	-0.6499 0.8444	-1.6147 0.7630	2.5268 0.9962	0
	Recurrent expenditure	LnX_2	Value P-value	-0.5586 0.8650	-3.1011 0.1242	4.4802 1.0000	0
1^{st} Difference	Gross domestic Product	ΔLnY	Value P-value	-4.0359 0.0042	-4.5428 0.0058	-2.7753 0.0072	0
	Capital expenditure	$DLnX_1$	Value P-value	-5.5063 0.0001	-5.4341 0.0007	-1.5951 0.1028	0
	Recurrent expenditure	$DLnX_2$	Value P-value	-7.9105 0.0000	-7.7768 0.0000	-0.6331 0.4324	0

4.2. ARDL BOUND COINTEGRATION TEST

Table 2: Cointegration Test

Critical value Bound of F statistic (trend and Intercept)						
K	90%		95%		99%	
	I(0)	I(1)	I(0)	I(1)	I(0)	I(1)
3	3.47	4.45	4.01	5.07	5.17	6.36
F-statistic value	8.2676	F-statistic P- value	0.0008	Chi square	24.8027	0.0000

Table 2 shows the results of the bounds cointegration test. The section of the Peseran et al (2001).

4.3. LONG RUN REGRESSION

Table 3: Summary of ARDL long Run Estimates

VARIABLE	COEFFICIENT	STD.ERROR	TRATIO	PVALUE	VIF
C	10.4449	0.1790	58.35	0.0000	
$lcexp_1$	-0.0780	0.0640	-1.217	0.2337	17.596
$lrcexp_2$	0.2665	0.0574	4.642	0.0000	17.596
R-squared	0.8834	DW P-value	0.0000	Breusch P-value	0.0872
Jarque-BeraTest	0.5362 (P VALUE)	F(2,28)	106.0485	RHO	0.7925

4.3.1. LONG RUN REGRESSION AFTER CORRECTION WITH ROBUST STANDARD ERROR

VARIABLE	COEFFICIENT	STD.ERROR	TRATIO	PVALUE	VIF
C	-0.2827	0.2582	-1.095	0.2830	
$lcexptr_1$	0.5808	0.1966	2.954	0.0063	3.837
$lrcexptr_2$	0.6665	0.2136	3.120	0.0042	3.837
R-squared	0.8434	DW P-value	0.5057	Breusch P-value	0.0018
Jarque-BeraTest	0.3053 (P VALUE)	F(2,28)	20.1707	RHO	-0.1039

It is revealed that that the problems identified in the data sets inflated the R2

4.4. SHORT RUN REGRESSION

VARIABLE	COEFFICIENT	STD.ERROR	TRATIO	PVALUE	VIF
C	-0.0452	0.0670	-0.6746	0.5059	

$lcexp_t$	0.6705	0.0986	6.7984	0.0000	2.937
$lrcexp_t$ ECM(-1)	0.4789 -1.1432	0.1046 0.1649	4.5815 -6.9329	0.0001 0.0000	2.906 1.024
R-squared	0.9427	DW P-value	0.3079	Breusch P-value	0.1677
Jarque-BeraTest Ramsey test	0.3278(P VALUE) 0.0953	F(3,26) Breusch (Heter.)	142.52 0.3319	RHO	0.1048

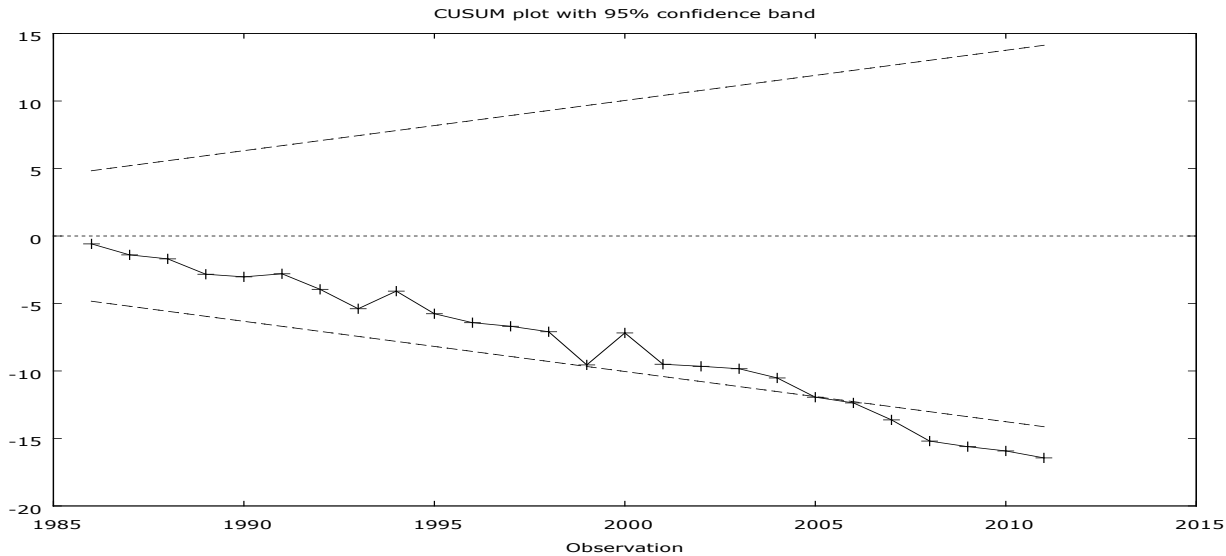

Figure 1

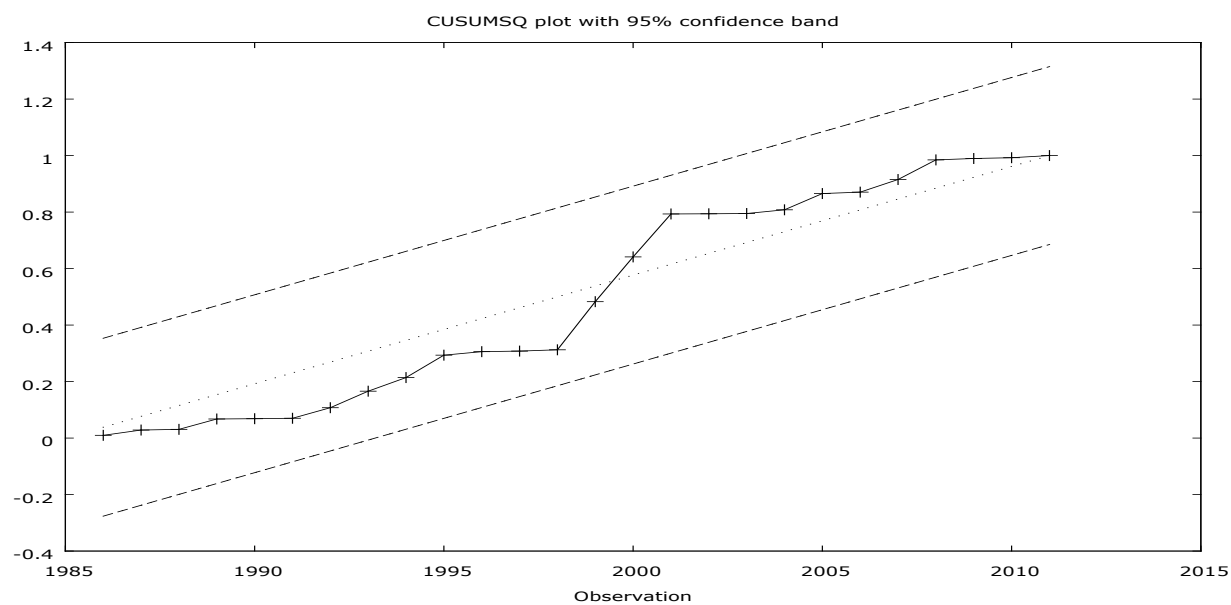

Figure 2

5.0. Conclusion

In this study, we examine the effect of capital and recurrent expenditure on gdp. Long run and short run relationship between economic growth and expenditures were examined using ARDL approach. ARDL bound test revealed that the variables are cointegrated. Recurrent and capital expenditure have a positive effect on gdp and are significant. The error correction mechanism has a negative sign and is significant.

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