Government expense, Consumer Price Index and Economic Growth in Cameroon

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Abstract:

This paper examines the relationship among consumer price index (CPI), economic growth and government expenditure, in case of Cameroon. The study employs many econometric tools to explore such relationship. And our findings suggest that there is a long term relationship between CPI, economic growth and government expenditure. Government expenditure has positive effect on growth. The study finds that in the short run CPI and government expenditure positively affect economic growth. To supplement these findings, we assess the causal relationships between variables using the Granger causality test. The results indicate that in the long-run economic growth Granger causes government current expenditure and; CPI Granger causes government current expenditure but no feedback relationship is observed.

Key-words: Government expenditure, Consumer Price Index, Economic Growth, ARDL-bounds test, Cameroon

JEL Classification: C22, F13, F21.

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1. Introduction

The size of government expenditures and its effect on long-run economic growth, and vice versa, has been an issue of sustained interest for decades. The received literature, essentially of an empirical nature, has proceeded as follow:

Bruno & Easterly 1998, Ericsson et al. 2001, Guerrero, 2006 have found the negative relationship between the inflation and growth regime. According to them, if the rate of inflation exceeds the threshold level the growth nexus is strongly (negatively) affected by the inflation.

The relationship between economic growth and government expenditure might be positive or negative or no relation depending upon the effect of government expenditure as summarizes in Table 1.

Table 1: Relationship between Government expenditure and Economic growth

Theories	Relationship	Reasons
Neo classical	-ve sign of government expenditure	Due to crowding out of the private investment
-	+ve sign of government expenditure	If the govt. expenditure create positive externalities & linkage
New classical	No relationship b/n govt. exp. & real income	New classical proposition of Ricardian equivalence hold

The negative relationship between the inflation rate and real income had been found, when the government expenditure was incorporated the expected sign between inflation and real income had changed. The positive relationship in long run had suggested that the moderate rise in the inflation should raise real income (Mallik & Chowdhury, 2002). Mallik and Chowdhury, 2002 had used the government expenditure in the aggregated sense in their function form.

The main objective for this study is to examine the relationship between government expenditure, consumer price index and growth in Cameroon. The study is relevant because the twin policy targets of state enterprise and private enterprise have been integral preoccupation of various government of Cameroon. And the study uses the recent ARDL bound testing technique. Then, the rest of the paper is structured as follow: section 2, deals with econometrics methodology; section 3 examines the empirical results and section 4 concludes the paper with final remarks.

2. Econometric Methodology

This study builds on the work of Mallik and Chowdhury (2002) by considering Cameroon perspective. It also investigates the relationship among the GDP, consumer price index and government expenditure, and follows the same function form as:

$$\ln Y_t = \beta_0 + \beta_1 t + \beta_2 \ln P_t + \beta_3 \ln G_t + \xi_t \qquad (1)$$

where: Y_t, G_t, P_t respectively represent real Gross Domestic Product (GDP), Government expense (G) and Consumer price index (CPI) at the same period *t*; β_0 and β_1 are respectively drift and trend components; $\beta_{i=3,4}$ is the associate coefficient to each explanatory variable; ξ is the white noise error terms; and *ln* is the natural logarithm operator.

In this study, we divide the government expenditures into: government current expenditures(GC); and government development expenditures(GD). First, the individual effect of both expenditures has been tested; and secondly, the combined effect of both expenditures has been taken as follow:

$$\ln Y_t = \beta_0 + \beta_1 t + \beta_2 \ln P_t + \beta_4 \ln GC_t + \xi_t \qquad (2)$$

$$\ln Y_t = \beta_0 + \beta_1 t + \beta_2 \ln P_t + \beta_5 \ln GD_t + \xi_t \quad (3)$$

$$\ln Y_t = \beta_0 + \beta_1 t + \beta_2 \ln P_t + \beta_4 \ln GC_t + \beta_5 \ln GD_t + \xi_t \quad (4)$$

The methodology used in this study is based on the ARDL-bounds testing approach, which was developed by Pesaran et al. (2001). It has three advantages in comparison with other previous and traditional cointegration methods. The first one is that this approach does not need that all the variables under study must be integrated of the same order and it can be applied when the underlying variables are integrated of order one, order zero or fractionally integrated. The second, the test is relatively more efficient in small or finite sample data sizes as is the case in this study. The procedure will however crash in the presence of an integrated series of an order upper than one.

Following Pesaran et al. (2001), in the first stage, the ARDL model of interest is estimated by using the OLS in order to test for the existence of a long-run relationship among the relevant variables. To test the null hypothesis of no long-run relation-ship among the variables in the equation, a Wald F-test for the joint significance of the lagged levels of the variables is performed. If the F-statistic is above the upper critical value, the null hypothesis of no long-run relationship can be rejected, irrespective of the orders of integration for the time series. Conversely, if the test statistic falls below the lower critical value, then the null hypothesis cannot be rejected. However, if the statistic falls between the upper and the lower critical values, then the result is inconclusive. Once the long-run relationship has been established, the second stage involves the estimation of the long-run coefficients. Thereafter, a general error-correction model (ECM) can be formulated as follows:

$$\Delta \ln Y_t = c_0 + d_0 t + \sigma_1 \ln Y_{t-1} + \sigma_2 \ln P_{t-1} + \sigma_3 \ln G_{t-1} + \sum_{i=1}^{p-1} \alpha_i \Delta \ln Y_{t-i} + \sum_{j=0}^{q_1-1} \kappa_j \Delta \ln P_{t-j} + \sum_{k=0}^{q_2-1} \eta_k \Delta \ln G_{t-k} + \varepsilon_t \quad (5)$$

$$\Delta \ln Y_t = c_1 + d_1 t + \rho_1 \ln Y_{t-1} + \rho_2 \ln P_{t-1} + \rho_3 \ln GC_{t-1} + \sum_{i=1}^{p-1} \alpha_i \Delta \ln Y_{t-i} + \sum_{j=0}^{q_1-1} \kappa_j \Delta \ln P_{t-j} + \sum_{k=0}^{q_2-1} \theta_k \Delta \ln GC_{t-k} + \nu_t \quad (6)$$

$$\Delta \ln Y_t = c_2 + d_2 t + \delta_1 \ln Y_{t-1} + \delta_2 \ln P_{t-1} + \delta_3 \ln GD_{t-1} + \sum_{i=1}^{p-1} \alpha_i \Delta \ln Y_{t-i} + \sum_{j=0}^{q_1-1} \kappa_j \Delta \ln P_{t-j} + \sum_{k=0}^{q_2-1} \lambda_k \Delta \ln GD_{t-k} + \zeta_t \quad (7)$$

$$\Delta \ln Y_t = c_3 + d_3 t + \omega_1 \ln Y_{t-1} + \omega_2 \ln P_{t-1} + \omega_3 \ln GC_{t-1} + \omega_4 \ln GD_{t-1} + \sum_{i=1}^{p-1} \alpha_i \Delta \ln Y_{t-i} + \sum_{j=0}^{q_1-1} \kappa_j \Delta \ln P_{t-j} + \sum_{k=0}^{q_2-1} \theta_k \Delta \ln GC_{t-k} + \sum_{l=0}^{q_3-1} \lambda_l \Delta \ln GD_{t-l} + \vartheta_t \quad (8)$$

where σ_i, ρ_i, δ_i and ω_i long-run multipliers corresponding to long-run relationships; c_i and d_i are drift and trend component; $\varepsilon_i, \nu_i, \zeta_t$ and ϑ_i are white noise errors. The short-run effects in the above equations are captured by the coefficients of the first differenced variables in the unrestricted ECM.

To test the existence of a long-run relationship for each of the above equations, we conduct an F-test for a joint significance of the coefficient of the lagged levels, by using the OLS. The general unrestricted error-correction model (UECM) is tested downwards sequentially, by dropping the statistically non-significant first differenced variables for each of the equations–to arrive at a ‘goodness-of-fit’ model–using a general-to-specific strategy.

3. Empirical Results

Before running the causality test, the variables[1] must be tested for stationarity. For this purpose, in this current study one uses the conventional Augmented Dickey Fuller (ADF) tests. The ARDL bounds test is based on the assumption that the variables are I(0) or I(1). The determination of the order of integration of all variables is another important issue. The objective is to ensure that the variables are not I(2) so as to avoid spurious results. In the presence of variables integrated of order two, one cannot interpret the values of the F statistics provided by Pesaran et al. (2001).

ADF, Phillips Perron (PP), and Dickey Fuller GLS (DF-GLS) unit root tests results are summarized in the Table 2. We applied a more efficient univariate DF-GLS test for autoregressive unit root recommended by Elliot *et al.* (1996). The test is a simple modification of the conventional ADF t-test as it applies generalized least squares (GLS) detrending prior to running the ADF test regression. Compared with the ADF tests, the DF-GLS test has the best overall performance in terms of sample size and power. It “has substantially improved power when an unknown mean or trend is present” (see Elliot *et al*, 1996). The test regression included both a constant and trend for the log-levels and first differences of the variables.

Table 2: ADF, PP and DF-GLS unit root test

Variables	ADF test	PP test	DF-GLS test	Decision
lnY	-1.011 (-3.903***)	-0.896 (-5.080***)	0.434 (-3.825***)	I(1)

[1] For this regression, we use data span extracted from the World Development Indicator 2012. The sample period is from 1960 to 2010

lnP	-2.628 (-4.458***)	-2.430 (-4.438***)	-0.082 (-3.750***)	I(1)
lnG	-0.662 (-4.407***)	-0.683 (-5.653***)	0.614 (-4.371***)	I(1)
lnGC	-1.407 (-7.125***)	-1.426 (-7.127***)	0.600 (-7.152***)	I(1)
lnGD	-2.534 (-3.441**)	-2.342 (-3.370**)	-1.357 (-3.416***)	I(1)

The corresponding tests for the first differences of each variable are shown in parentheses. *** and ** respectively denote de significance at the 1% resp. 5% level, using the Mackinnon (1991), for ADF and PP, and Elliot-Rothenberg(1996), for DF-GLS, finite sample critical values.

The unit root tests results for the variables reported in Table 2 indicate that all variables are I(1) i.e. their first difference are stationary. Thus, we can exclude the possibility of seasonal roots and explosive roots. Considering the above-mentioned results of unit root tests, this paper does conduct ARDL cointegration tests and consequently, applies the vector autoregression (VAR) model for the analysis based on the selection of the VAR optimal lag orders.

Table 3: VAR lag order selection criterion of models based on AIC and SC

	$\ln Y = f(\ln P, \ln G)$		$\ln Y = f(\ln P, \ln GC)$		$\ln Y = f(\ln P, \ln GD)$		$\ln Y = f(\ln P, \ln GC, \ln GD)$	
Lags	**AIC**	**SC**	**AIC**	**SC**	**AIC**	**SC**	**AIC**	**SC**
1	-10.12	-9.63*	-7.75*	-7.24*	-8.20*	-7.65*	-10.36*	-9.45*
2	-10.36*	-9.48	-7.57	-6.66	-7.92	-6.95	-9.99	-8.33
3	-10.12	-8.85	-7.17	-5.86	-7.76	-6.36	-9.67	-7.25

AIC and SC are respectively Akaike and Schwarz Information Criterion; * represent the optimal value and the corresponding lag

In order to select the optimal lag order for the VAR from the above Table 3, the four VAR of order three have been calculated over the time period of 1960 to 2010. However, AIC criteria implied that the order is 1;

nearly for all models, the Schwarz information Criterion also implied that the order is 1. In the light of above statistics it has been decided to choose VAR(1) for all models except Model (1) in which we choose lag 2.

Following the selection of the VAR optimal lag orders, in Table 4 we report the results of the ARDL-bounds test. At this stage, the ARDL cointegration test has been established of a long run relationship among the variables through F-test statistics by applying Bound Test. Then firstly, OLS is calculated to measure the long run relationship. And secondly, F-statistics have been calculated by applying the Wald test on the estimation of OLS calculated at the previous step.

Table 4: ARDL-bounds test

Functions	Optimal Lag	F-stat	Decision
$F_{\ln Y}\left(\ln Y \mid \ln P, \ln G\right)$	2	8.768***	Cointegrated
$F_{\ln Y}\left(\ln Y \mid \ln P, \ln GC\right)$	1	1.540	No Cointegration
$F_{\ln Y}\left(\ln Y \mid \ln P, \ln GD\right)$	1	17.220***	Cointegrated
$F_{\ln Y}\left(\ln Y \mid \ln P, \ln GC, \ln GD\right)$	1	12.404***	Cointegrated
Critical values for k = 2	U. bound at 1% 7.52 L. bound at 1% 6.34	U. bound at 5% 5.85 L. bound at 5% 4.87	Upper bound at 10% 5.06 Lower bound at 10% 4.19
Critical values for k = 3	U. bound at 1% 6.36 L. bound at 1% 5.17	U. bound at 5% 5.07 L. bound at 5% 4.01	Upper bound at 10% 4.45 Lower bound at 10% 3.47

***, ** and * respectively indicates that the test statistic is above 1%, 5% and 10% upper critical value of the Pesaran *et al.*(2001) finite sample table of case 5 that there is a cointegration between variables.

The calculated F-statistic $F_{\ln Y}\left(\ln Y \mid \ln P, \ln G\right) = 8.768$, $F_{\ln Y}\left(\ln Y \mid \ln P, \ln GD\right) = 17.22$ and $F_{\ln Y}\left(\ln Y \mid \ln P, \ln GC, \ln GD\right) = 12.404$ are higher than the upper bound critical value at 1%, 5% and 10% level. Thus, the null hypothesis of no cointegration is rejected, implying long-run cointegration relationships amongst the variables when the regressions are respectively normalized on *Y* and *G* and *GD* variables

In the previous third stage our findings indicate the long relationship among the variables. Now, the fourth stage is to estimate the long run and the short run coefficients. In the first point, the long run coefficients have been estimated by using the OLS technique. The results of the long run estimates are displayed in Table 5:

Table 5: Long-run estimates: Cameroon 1960 to 2010

	Models			
Variables	$\ln Y = f(\ln P, \ln G)$	$\ln Y = f(\ln P, \ln GC)$	$\ln Y = f(\ln P, \ln GD)$	$\ln Y = f(\ln P, \ln GC, \ln GD)$
Drift	1.581***	-	12.216***	12.597***
Trend	-0.005***	-	0.0074**	0.0073**
lnP	0.123***	-	-0.099	-0.102
lnG	0.741***	-	-	-
lnGC	-	-	-	0.057
lnGD	-		0.224200***	0.220***
Model structure	(2,0,2)	-	(1,1,1)	(1,1,0,1)

Note: Dependent variable is $\ln Y_t$. ***, ** and * respectively indicates significance at 1%, 5% and 10%

In the case of Model (1), the results above in Table 5 suggest that there is a positive coefficient of the CPI, which is statistically significant. Whereas in the case of the other models (Model 3 and 4), the coefficient of CPI is statistically insignificant.

Regarding the government expenditure variable, its coefficient is statistical positively significant and found same sign as Mallik and Chowdhury, 2002.

Model (4) shows that the coefficient of government current expenditure has a statistically insignificant positive effect on economic growth in the long run. The coefficient of government development expenditure is positive statistically significant, in Model (3) and (4). The results of the short-run dynamics emanating from the long-run relationships are shown in Tables 6(a), 6(b) and 6(c).

Table 6a: Error Correction representation for the selected ARDL: model (1)

Variables	Coefficients	Standard Error	T-ratio	P-value
DlnP	0.030676	0.052647	0.582679	0.5638
DlnG	0.739296	0.054264	13.62405	0.0000
$DlnY_{-1}$	0.540950	0.209261	2.585047	0.0141
$DlnP_{-1}$	0.050129	0.055294	0.906585	0.3708
$DlnG_{-1}$	-0.400875	0.168278	-2.382215	0.0228
ECM_{-1}	-0.917959	0.295288	-3.108690	0.0037

Note: D is the difference operator; Dependent variable is DlnY.
R-squared=0.89, R-bar-squared=0.87, S.E. regression= 0.019, AIC=-4.86, SC=-4.61, DW=2.06, F-stat=7.26[P-value = 0.00]

Table 6b: Error Correction representation for the selected ARDL: model (3)

Variables	Coefficients	Standard Error	T-ratio	P-value
DlnP	0.266618	0.077000	3.462572	0.0017
DlnGD	0.319052	0.045333	7.037968	0.0000
ECM_{-1}	-0.369381	0.296014	-1.247850	0.2224

Note: D is the difference operator; Dependent variable is DlnY.
R-squared=0.66, R-bar-squared=0.64, S.E. regression= 0.036, AIC=-3.71, SC=-3.57, DW=2.00,

Table 6c: Error Correction representation for the selected ARDL: model (4)

Variables	Coefficients	Standard Error	T-ratio	P-value
DlnP	0.225005	0.079495	2.830422	0.0087
DlnGC	0.097416	0.067119	1.451377	0.1582
DlnGD	0.302892	0.045422	6.668405	0.0000
ECM-1	-0.550190	0.301010	-1.827816	0.0786

Note: D is the difference operator; Dependent variable is DlnY.

R-squared=0.70, R-bar-squared=0.66, S.E. regression= 0.034, AIC=-3.74, SC=-3.56, DW=2.05,

The short run coefficients have been estimated in the second point. The estimated results of ECM allow measuring the speed of the adjustments required to adjust to long run values after a short term shock.

As can be seen from Table 6a, the coefficient of the changes in the government expenditure *DlnG* is positive statistically significant at 1%. This implies that, in addition to having a statistically long-run positive impact, the government expenditure has also a positive impact on economic growth in the short run. The coefficient Error Correction Model has the expected sign, found to be fairly large and statistically significant at 1% level.

In Table 6b, the coefficient of the change in the CPI variable is positive statistically significant at the 1% level. The coefficient of the changes in lnGD is statistically significant and has a positive sign. As in the case of Table 5a, the coefficient ECM(–1) is also found to be fairly large – even though in this case, the ECM is statistically insignificant.

As in Table 6b, Table 6c shows that the coefficients of the CPI and the GD variables are positive and both statistically significant at 1% level. However, the coefficient of the GC is statistically insignificant. The coefficient ECM(–1) is found to be fairly large and statistically significant at 10% level. Therefore the ECM coefficient is fairly large with the expected sign and which implies that 91.7% and 55.0% of the disequilibria in the in GDP of the previous year's shocks adjust back to the long run equilibrium in the current year.

In order to determine the number of cointegrating relationships, the robustness of ARDL bound test of cointegration is checked by using the

Johansen Cointegration Test. The results of trace statistics tests, is reported in Table 6.

Table 7: Cointegration Test Statistic for lnY: Cameroon 1960 to 2010

	Data Trend:	None	None	Linear	Linear	Quadratic
	Test Type	No Intercept No Trend	Intercept No Trend	Intercept No Trend	Intercept Trend	Intercept Trend
Model 1	Trace	1	0	0	1	1
	Max-Eig	1	1	0	1	1
Model 3	Trace	0	0	0	0	0
	Max-Eig	0	0	0	0	0
Model 4	Trace	1	1	0	1	1
	Max-Eig	1	0	0	0	0

These results argue that long run equilibrium exists between the variables *Y, P, G, GC, and GD.* Then, it will be concluded that there exist in terms of Cameroon long relationship between the GDP, rate of inflation and government expenditure. The trace statistics indicates that there are two numbers of cointegration equations at the 5% level which confirm the results of the Pesaran et al. (2001) cointegration approach.

In order to determine the direction of causality between the variables of Cameroon, the Granger Causality test has been used. It measures the two ways causality means the cause and effect relationship between two or more variables.

Table 8: Pairwise Granger Causality Tests

Null Hypothesis:	Obs	F-Statistic	P-value
LNY does not Granger Cause LNG	50	0.00363	0.9522
LNG does not Granger Cause LNY		0.80115	0.3753
LNP does not Granger Cause LNG	42	0.16902	0.6832
LNG does not Granger Cause LNP		0.67557	0.4161
LNY does not Granger	47	11.1063	0.0018

Cause LNGC			
LNGC does not Granger Cause LNY		0.21540	0.6449
LNY does not Granger Cause LNGD	32	2.81753	0.1040
LNGD does not Granger Cause LNY		1.41216	0.2443
LNP does not Granger Cause LNGC	39	7.39401	0.0100
LNGC does not Granger Cause LNP		0.75818	0.3897
LNP does not Granger Cause LNGD	32	1.86397	0.1827
LNGD does not Granger Cause LNP		0.23412	0.6321
LNP does not Granger Cause LNY	42	0.12917	0.7212
LNY does not Granger Cause LNP		0.77039	0.3855

The * and ** respectively indicates the rejection of null hypothesis at 10% and 5% significant level.

The Granger Causality test results seen in Table 8 reveal the existence of the unidirectional causality between GDP and government current expenditure; CPI and government current expenditure. Also the test results show that there is no causal relationship between GDP and government expenditure; GDP and CPI; GDP and government development expenditure. Besides, these results underline no directional causality between CPI and government development; and CPI and government development expenditure.

Table 9 presents some diagnostic statistics. To investigate the serial correlation, Normality, Heteroskedasticity and functional form, we respectively apply the Breusch-Godfery Langrage Multiplier (LM), Jarque Bera student, White (no cross term) and Ramsey RESET test and the result has been concluded by allowing for up to one lag:

Table 9: ARDL-VECM diagnostic tests

	$\ln Y = f(\ln P, \ln G)$		$\ln Y = f(\ln P, \ln GD)$		$\ln Y = f(\ln P, \ln GC, \ln GD)$		
LM Tests statistics	**Value**	**Prob**	**Value**	**Prob**	**Value**	**Prob**	**Null hypothesis**
Serial correlation	0.14	0.70	6.63	0.01	1.42	0.23	No serial correlation
Normality	1.65	0.43	1.80	0.40	1.94	0.37	Normality distribution
Heteroskedasticity	9.67	0.20	4.63	0.20	8.12	0.32	Homoskedasticity
Functional form	2.65	0.11	1.93	0.17	0.18	0.67	Good specification

Serial correlation is the Breusch-Godfrey test; Normality is the Jarque Bera test; Heteroskedasticity test is the White (no cross term) and Functional form is the Ramsey RESET test.

In both models (2 and 4), the Lagrange Multiplier (LM) tests indicate no evidence of serial correlation in the residuals. While concerning the Model (3) the null hypothesis has been rejected; the multivariate normality tests show that the residuals are Gaussian in each model; for the Heteroskedasticity, the acceptance of null hypothesis for all models i.e. presence the homoscedasticity; and, the acceptance of null hypothesis in the functional form for all models means good specification.

Finally, the model has passed through the stability test. The cumulative sum of recursive residuals (CUSUM) and the cumulative sum of squares of recursive residuals (CUSUMSQ) are used as the last stage of ARDL estimation to check that all coefficients in ECM model are stable or not. The plots of CUSUM and CUSUMSQ statistics are presented in Fig 1(a), (b) and (c):

Figure 1a: Plot CUSUM and CUSUM² for stability coefficient for ECM: Model 1

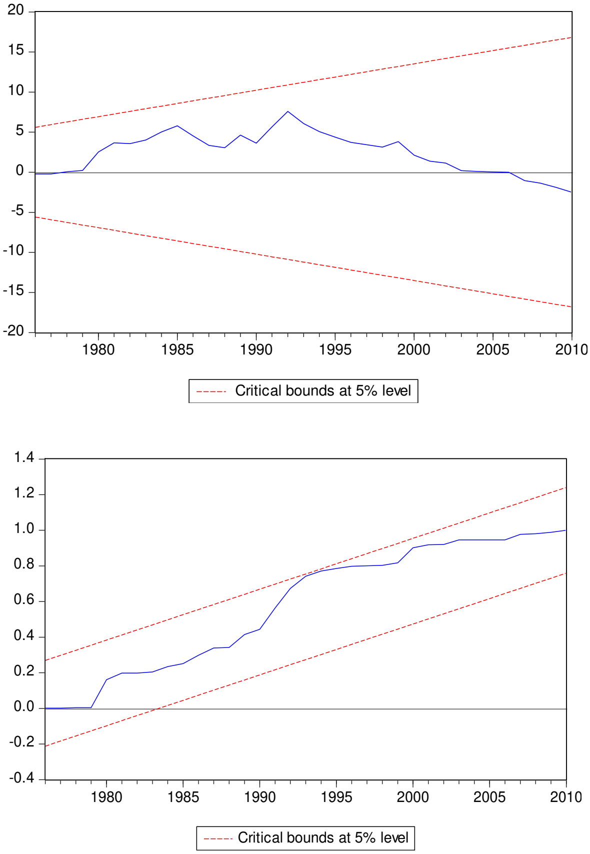
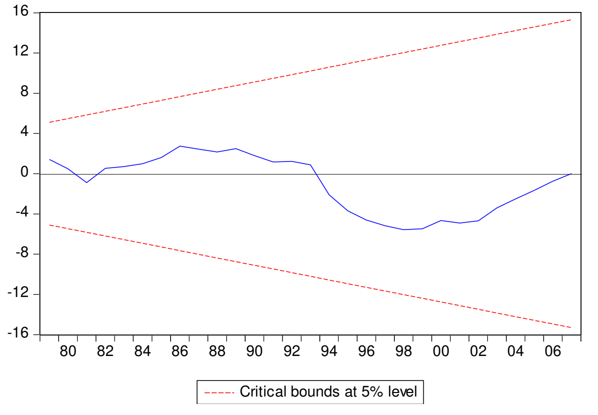


Figure 1b: Plot CUSUM and CUSUM² for stability coefficient for ECM: Model 3



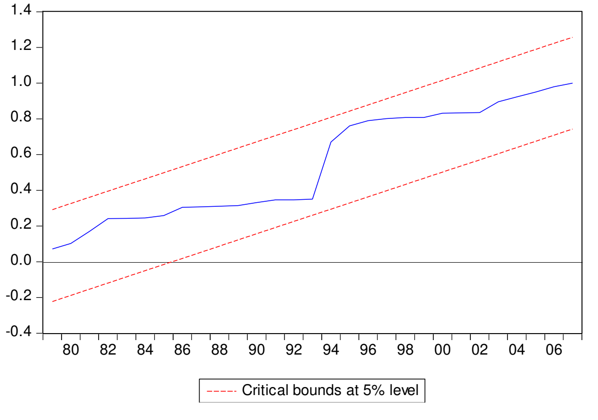
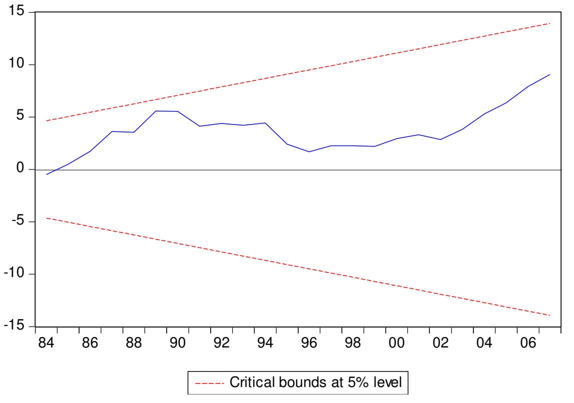


Figure 1c: Plot CUSUM and CUSUM² for stability coefficient for ECM: Model 4



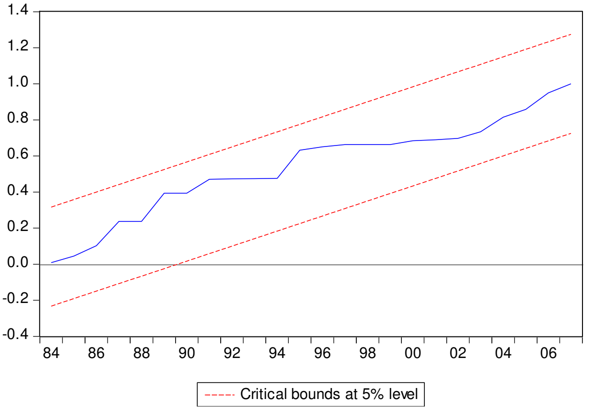


Fig 1(a), (b) and (c) indicates the plot of cumulative sum of recursive residuals (CUSUM) and the cumulative sum of squares of recursive residuals (CUSUMSQ) that all the coefficients in the estimated ECM model are stable over the sample period at the 5% level of significant. And all the models can be evaluated for an effective policy analysis by the policy makers.

Conclusion and some recommendation

In this article, we examine the relationship among CPI, economic growth and government expenditure, in case of Cameroon over the period 1960-2012. Our results show that CPI and GDP are positively related in the long-run. The estimated relationship between real income and government expenditure is positive and the same sign had been found in the case others countries (see Mallik and Chowdhury, 2002). The coefficient of government development expenditure is statistically significant, that shows that the government expenditures yield positive externalities and linkages. The results argue that long run equilibrium exists between our variables of interest. The Granger causality results suggest that even though the existence of the unidirectional causality between GDP and government current expenditure; CPI and government current expenditure. Besides the previous finding, these results underline no directional causality between CPI and government development; and CPI and government development expenditure.

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