Journal of Finance and Economics, 2017, Vol. 5, No. 4, 171-178
Available online at http://pubs.sciepub.com/jfe/5/4/3

DOI:10.12691/jfe-5-4-3

Current Account Deficit Sustainability in CEMAC: A Threshold Cointegration Approach

DIAKITE Ouei Karim, DRAMA Bédi Guy Hervé*

Department of Economics, University Peleforo Gon Coulibaly of Korhogo, Côte d'Ivoire
*Corresponding author: dramsiben.upgck@gmail.com

Abstract Whether or not a current account deficit is sustainable has important implications for policy. If the current account deficit of a nation is sustainable, then it implies that the government should have no incentive to default on its international debt. In this article, we examine whether or not the current account deficits of the Economic and Monetary Community of Central African countries are sustainable. The econometric methodology adopted threshold cointegration test advanced by Enders and Siklos [7]. The findings indicate that: (1) the current account deficits are only strong sustainable for Chad and weakly sustainable for Central Africa Republic, Congo and Gabon; (2) the results from panel cointegration test showed that current account deficits are weakly sustainable in CEMAC area; (3) Cameroon and Equatorial Guinea are in violation of their international budget constraints and should therefore put in place policies to reduce their current account deficits in order to regain their external stability; and (4) For the other country members of CEMAC where sustainability was found to be weak, they should also implement policies to reinforce the sustainability of the current account deficits.

Keywords: *current account, sustainability, CEMAC, threshold cointegration*

Cite This Article: DIAKITE Ouei Karim, and DRAMA Bédi Guy Hervé, "Current Account Deficit Sustainability in CEMAC: A Threshold Cointegration Approach." *Journal of Finance and Economics*, vol. 5, no. 4 (2017): 171-178. doi: 10.12691/jfe-5-4-3.

1. Introduction

Maintaining balanced current accounts is a tremendous challenge that faces many developing countries in general and African countries in particular. This is because, on one hand, most countries depend largely on imports of various types of goods for the consumption of both the rapidly growing populations and investment sectors. On the other, their export sector is still uncompetitive in the world markets. Consequently, the growing gap between rapidly expanding imports and shrinking or stagnant export sectors causes current account deficits to be unsustainable over times since current account deficits are a reflection of either the strength of domestic economies as they measure resource inflows into a country or an accumulation of debts that cannot be serviced in the future. A mixture of external and internal factors such as unsustainable fixed exchange rate regimes, real exchange rate appreciation, and continuous deterioration of terms of trade and current account imbalances, short-term foreign debts and weak financial system are believed to cause persistent current account deficits.

The concept of current account simply represents an analysis of whether the country is capable of fulfilling its long-run intertemporal budget constraint without triggering dramatic economic upheavals that can cause painful adjustments. Long episodes of unsustainable current fluctuations can doubtlessly initiate either sudden exchange rate crisis that is reminiscent of those observed in Chile in 1982, Mexico in 1994-95 and the Southeast Asia countries in 1997 or an accumulation of foreign debts that the country may not be able to service in the long run, eventually triggering a crisis. Furthermore, large and growing current account deficits usually cause negative net international investment position to grow larger, eventually generating financial burden such as interest rates and dividends to the extent of adversely affecting domestic consumption and business investment. Mann (2002) described current account sustainability as a situation in which external imbalances do not generate economic forces that can steer the economy away from its long-term path.

When countries run large current account deficits, there is always general nervousness on the side of financial world as to whether these countries could be able to sustain such deficits for long time. This raises the need for some rule or criterion for gauging whether a given current account deficit is sustainable or not. In this respect, Milesi-Ferretti and Razin [14] suggested that a current account deficit of say, 5 percent of gross domestic product (GDP), should constitute an appropriate alarm bell to policy makers. They acknowledged the need for such a rule especially when the deficit is financed with short-term debts or foreign exchange reserves and particularly when the deficit reflects the high consumption spending rather than investment although they questioned the seriousness with which such rule should be taken.

However, a closer look at historical episodes of economic crises revealed that not all large current-account deficits always lead to external crises. Experience shows

that a number of countries that included Australia, Ireland, Israel, Malaysia and South Korea were able to sustain large current-account deficits for a number of years without necessarily triggering large-scale currency crisis. However, others such as Chile, Mexico and the Southeast Asian countries (especially Malaysia, the Philippines and Thailand) suffered severe crisis in 1997. As deficit/GDP ratio is not a reliable rule, Milessi-Ferretti and Razin [14] further suggested the country's solvency for evaluating the unsustainability of large current account deficits. That is, does the country have the ability to generate sufficient trade surpluses to repay its accumulated debts in the future? Furthermore, they drew a distinction between solvency and sustainability by arguing that an economy is considered solvent if the expected present value of future trade surpluses equals the economy's current accumulated debt. On the one hand, the notion of solvency should be satisfied when the country satisfies its intertemporal budget constraint, that is, as long as the discounted value of country's foreign debt is non-zero in the infinite limit provided that the country should not increase its foreign debt faster than the real interest rate on the accruing debt. This criterion implies that a country could run very large current account deficits and be solvent provided that first, there are expected surpluses in the future and second, the country's stock of foreign debt can increase without limits as long as the country does not increase it faster than the real interest rate. On the other, a sustainable current account is one that does not trigger feedbacks on domestic saving and investment or cause significant international portfolio reallocations that leads to a rise in interest rates. Thus, when a country runs a persistent large and growing current account deficit, it would inevitably generate changes in GDP growth and thus, in import spending, causing its present level to be unsustainable. However they expressed doubts about the appropriateness of solvency concept as a criterion for evaluating the country's current account sustainability since it considers only the country's ability rather than its willingness to pay. Although the present value of trade surpluses could be sufficient to repay the country external debts, theoretically, however, diverting output from domestic consumption to debt servicing can possibly involve high political risks. In addition, the concept relies on unrealistic assumptions that foreign investors are willing to lend to the country on current terms irrespective of the country's ability to meet its debt obligation. In absence of external shocks and macroeconomic policy changes, current account is sustainable only as long as no external sector crisis occurs.

Roubini and Wachtel [21] who considered this theoretical current-account sustainability criterion not to be stringent enough since the intertemporal budget constraint only imposes very mild restrictions on the evolution of the country's current account and foreign debt suggested the non-increasing foreign debt to GDP ratio as the practical sufficient condition for sustainability. However, they recognized the need to distinguish between current account deficits that arise from growth-inducing capital inflows and current account deficits that result in debt accumulation that cannot be sustained. Based on these considerations, a sustainable current account deficit is, therefore, one that can be maintained without any of these crises occurring.

When testing for cointegration between imports and exports, most of studies use linear cointegration tests of Engle and Granger [8], Johansen [13] and Pesaran et al. [17] all of which assume symmetric adjustment towards the long-run equilibrium. According to Balke and Fomby [2], because of the presence of transaction costs and asymmetries in price transmission, there is no reason to expect a symmetric adjustment. They therefore initiated the idea of threshold cointegration where the adjustment towards the long-run equilibrium occurs only when the deviation from the equilibrium exceeds some threshold [23]. Following Balke and Fomby [2], Enders and Granger [6] and Enders and Siklos [7] employed threshold Autoregressive (TAR) and Momentum threshold Autoregressive (M-TAR) models to develop a threshold cointegration test which allows for asymmetric adjustment towards the long run equilibrium.

The objective of this paper is to establish the relationship between imports and exports using the threshold cointegration test advanced by Enders and Siklos [7] to test the sustainability of the current account deficits in the six African countries of CEMAC area. For this purpose, we organize the rest of the paper as follow; Section II presents the conceptual framework; section III, the data and methodology used. Section IV presents and discusses the results and section V gives the concluding remarks.

2. The Conceptual Framework

Testing for the cointegration relationship between imports and exports as a way of checking the sustainability of current account deficits was first proposed by Hakkio and Rush [9] and Husted [11].

They proposed a conceptual framework in which a representative individual of a small open economy faces the following budget constraint:

$$C_0 = Y_0 + B_0 - I_0 - (1+r_0)B_{t-1} \tag{1}$$

Where C_0, Y_0 and I_0 stand for current consumption, income and Investment respectively. B_0 is the current borrowing, $(1+r_0)B_{t-1}$ is the initial debt size and r_0 is the world interest rate.

Solving for B_0 in equation (1) yields expression (2) where the trade balance $(X-MM)_t = Y_t - C_t - I_t$ and ϖ_t is the discounting factor:

$$B_0 = \sum_{t=1}^{\infty} \varpi_t (X-MM)_t + \lim_{n\to\infty} \varpi_n B_n. \tag{2}$$

To get a testable equation, Husted [11] makes the following assumption where $W_t = MM_t + (r_t - r)B_{t-1}$ and MM_t is expenditure on imports:

$$X_t + B_t = W_t + (1+r)B_{t-1}, \tag{3}$$

From equation (3), solving for $MM_t + r_t B_{t-1}$ yields:

$$MM_t + r_t B_{t-1} = X_t + \sum_{j=0}^{\infty} \lambda^{j-1}\left[\Delta X_{t+j} \quad -\Delta W_{t+j}\right] + \lim_{j\to\infty} \lambda^{t+j} B_{t+j} \tag{4}$$

Husted [11] assumes further that expenditure on imports and exports are non-stationary processes which can be written as:

$$W_t = \theta_1 + W_{t-1} + \mu_{1t} \quad (5)$$

$$X_t = \theta_2 + X_{t-1} + \mu_{2t}. \quad (6)$$

Substituting equations (5) and (6) in equation (4) and rearranging gives:

$$X_t = \left[(1+r)/r\right](\theta_1 - \theta_2) + (MM_t + r_t B_{t-1}) - \lim_{j\to\infty} \lambda^{t+j} B_{t+j} + \sum_{j=0}^{\infty} \lambda^{j-1}(\mu_{1t} - \mu_{2t}). \quad (7)$$

By letting $\beta = \left[(1+r)/r\right](\theta_1 - \theta_2)$ and

$$u_t = \sum_{j=0}^{\infty} \lambda^{j-1}(\mu_{1t} - \mu_{2t}),$$

equation (7) can be written as:

$$X_t = \beta + (MM_t + r_t B_{t-1}) - \lim_{j\to\infty} \lambda^{t+j} B_{t+j} + u_t, \quad (8)$$

Finally, equation (8) can be written as follows where $M_t = MM_t + r_t B_{t-1}$ and assuming that $\lim_{j\to\infty} \lambda^{t+j} B_{t+j} = 0$:

$$X_t = \beta + \delta M_t + u_t. \quad (9)$$

According to Hakkio and Rush [9] and Husted [11], the current account deficits are sustainable if exports X_t, and imports M_t, are cointegrated. It has been argued however that for the current account deficits to be strongly sustainable, the sufficient condition should be that $\delta = 1$ and in case $0 < \delta < 1$, they are only weakly sustainable [10,20,22,25]

3. Data and Methodology

3.1. Data

We used annual data on exports and imports (in logarithm) for the six Economic and Monetary Community of Central African countries namely Cameroon, Chad, Central African Republic, Congo, Gabon and Equatorial Guinea covering the period 1960-2014. Data were collected from World Development Indicator 2016. Table 1 presents descriptive statistics of exports and imports (in logarithm) by country and Figure 1, their evolution on the entire period of study. As we see, mean (respectively, standard deviation, minimum and maximum) of exports and imports by country are close to each other. And the graph seems to indicate that imports and exports have a co-movement between them, giving an impression that there might be a cointegration relationship between them in the countries under study.

Table 1. Descriptive Statistics

Variable	Obs.	Mean	Std. Dev.	Min	Max
		Cameroon			
Exports	50	21.165	1.014	19.003	22.671
Imports	50	21.195	1.023	19.101	22.916
		Central Africa Republic			
Exports	50	18.833	0.556	17.524	19.503
Imports	50	19.226	0.620	17.853	20.234
		Chad			
Exports	50	19.556	1.442	17.818	22.283
Imports	50	20.039	1.323	18.123	22.500
		Congo			
Exports	50	20.771	1.520	18.004	23.256
Imports	50	20.736	1.234	18.472	23.021
		Equatorial Guinea			
Exports	50	19.172	2.441	16.811	23.452
Imports	50	19.664	2.200	16.143	23.113
		Gabon			
Exports	50	21.308	1.271	18.397	23.117
Imports	50	20.957	1.085	18.251	22.561
		CEMAC			
Exports	300	20.150	1.769	16.811	23.451
Imports	300	20.319	1.497	16.143	23.113

Source: Own computation

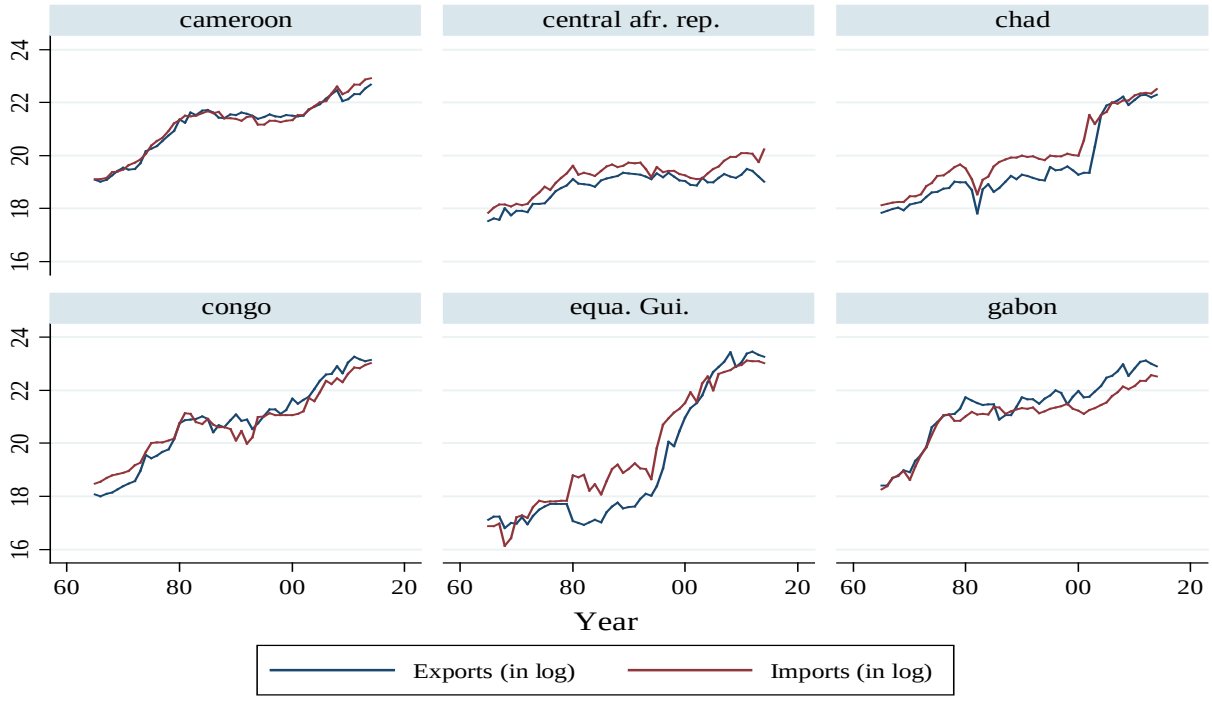

Figure 1. Evolution of Exports and Imports (in log) in CEMAC countries

3.2. Methodology

Threshold cointegration technique initiated by Enders and Granger [6] and Enders and Siklos [7] is presented hereafter, method which is employed in this study to test for cointegration between imports and exports in our Central African Countries.

Extending Engle & Granger's [8] linear cointegration test, Enders and Granger [6] and Enders and Siklos [7] developed a threshold cointegration test where negative and positive deviations from the long-run equilibrium are not corrected in the same way, that is, in which the adjustment towards the long-run equilibrium is asymmetric [23].

Let x_t and m_t be the logarithm of exports and imports respectively. Using TAR and *M*-TAR models, Enders and Siklos [7] propose the following steps to test for threshold cointegration.

In the first step, the following long-run equilibrium relationship is estimated:

$$x_t = \alpha_1 + \alpha_2 m_t + u_t. \tag{10}$$

In the next step, the following equation is estimated using Ordinary Least Squares (OLS):

$$\Delta u_t = I_t \rho_1 u_{t-1} + (1 - I_t)\rho_2 u_{t-1} + \sum_{i=1}^{k} \alpha_i \Delta u_{t-i} + \eta_t \tag{11}$$

where u_t is the residuals series from equation (10) and I_t is the Heaviside indicator function such that:

$$I_t = \begin{cases} 1 \ if \ u_{t-1} \geq \lambda \\ 0 \ if \ u_{t-1} < \lambda \end{cases} \text{ for TAR model} \tag{12}$$

$$I_t = \begin{cases} 1 \ if \ \Delta u_{t-1} \geq \lambda \\ 0 \ if \ \Delta u_{t-1} < \lambda \end{cases} \text{ for M-TAR model} \tag{13}$$

Where λ is the threshold value to be estimated.

Equations (11) and (12) together form the threshold autoregressive model (TAR) and equations (11) and (13) form the momentum threshold autoregressive model (M-TAR). The threshold value is selected using Chan's [3] method where the optimum value is such that the residuals sum of squares is at a minimum [24]. From equation (11), to test for threshold cointegration, Enders and Granger [6] and Enders and Siklos (2001) propose to test the following hypothesis of no threshold cointegration:

$$H_0 : \rho_1 = \rho_2 = 0.$$

The test statistic used is known as Φ statistic and the critical values are from Enders and Siklos [7].

4. Empirical Investigations

Before running the cointegration test, the variables must be tested for stationarity. For this purpose, the traditional Augmented Dickey-Fuller [4] test is used to test for the order of integration of exports and imports in CEMAC countries. Unit root test results are presented in Table 2 and suggest that exports and imports (in logs) for all the CEMAC area are nonstationary processes becoming stationary after one differentiation. Since imports and exports are both integrated of order 1 for all the countries under study, we can test for cointegration relationship between them.

Table 3 and Table 4 present the results of threshold cointegration test between imports and exports for the CEMAC countries, using TAR and momentum TAR models. The optimal threshold value λ minimizing the residuals sums of squares was estimated using Chan's [3] method. For the TAR model for instance the estimated threshold value is $\lambda^* = -0.149$ for Cameroon, $\lambda^* = -0.151$ for Central Africa Republic, $\lambda^* = -0.243$ for Chad, $\lambda^* = 0.127$ for Congo, $\lambda^* = 0.475$ for

Equatorial Guinea and $\lambda^* = 0.156$ for Gabon. For the M-TAR model, the estimated threshold value for each country is reported in Table 4. The results in Table 3 and Table 4 indicate also that Ljung-Box test fails to reject the null hypothesis of no serial correlation at 5 % level of significance.

Using Akaike Information Criterion (AIC), the number of lags k to include in the TAR and M-TAR models was also selected. For the M-TAR model for instance, out of a maximum of 7 lags, AIC selects a lag of 1 for Cameroon and Chad and a lag of 0 for the rest of countries. It should be noted that for the TAR model, AIC selects also the same lags.

We took into account the estimated threshold value and optimal lag length selected to test for threshold cointegration between imports and exports.

Threshold cointegration tests results based on the TAR model are reported in Table 3. They indicate that the Φ test statistic rejects the null hypothesis of no threshold cointegration $(H_0 : \rho_1 = \rho_2 = 0)$ at 5% level of significance for Central Africa Republic, Chad, Congo and Gabon and at 10% level of significance for Cameroon and Equatorial Guinea. Thus, the estimated TAR model for Chad (for example) can be written as follows with standard deviation in parentheses:

$$\Delta\hat{u}_t = \underset{(0.182)}{-0.219}\, I_t\hat{u}_{t-1} - \underset{(0.141)}{0.575}\,(1-I_t)\hat{u}_{t-1} + \underset{(0.140)}{0.297}\,\Delta\hat{u}_t$$

$$\text{where } I_t = \begin{cases} 1 if\ u_{t-1} \geq -0.243 \\ 0 if\ u_{t-1} < -0.243 \end{cases}.$$

Based on the Momentum TAR model, the results of threshold cointegration are reported in Table 4. They show that the null hypothesis of no threshold cointegration can be rejected at 5% level for all countries except Equatorial Guinea. Thus, the estimated M-TAR model for Chad (for example) can be written as follows:

$$\Delta\hat{u}_t = \underset{(0.16)}{0.35}\, I_t\hat{u}_{t-1} - \underset{(0.17)}{0.54}\,(1-I_t)\hat{u}_{t-1} + \underset{(0.15)}{0.32}\,\Delta\hat{u}_t$$

$$\text{where } I_t = \begin{cases} 1 if\ u_{t-1} \geq -0.154 \\ 0 if\ u_{t-1} < -0.154 \end{cases}.$$

Together, Table 3 and Table 4 also indicate that the null hypothesis of no threshold cointegration is rejected for Central Africa Republic, Chad, Congo and Equatorial Guinea at 5% level for both TAR and M-TAR models. However, for Cameroon and Equatorial Guinea, the null hypothesis of no cointegration could not be rejected at 5% level for both TAR and M-TAR model.

Table 2. ADF Unit Root Test

Country	Cameroon	Cent. A. Rep.	Chad	Congo	Eq. Guinea	Gabon
			Level data			
Exports	-1.856	-1.328	-1.983	-2.067	-1.691	-2.391
Imports	-1.673	-1.782	-2.034	-1.915	-2.707	-2.429
			Differenced data			
Exports	-4.195[b]	-5.310[b]	-5.016[b]	-4.881[b]	-3.816[b]	-4.743[b]
Imports	-4.340[b]	-4.697[b]	-4.603[b]	-4.886[b]	-5.738[b]	-3.956[b]

These tests consider intercept and linear trend case. The superscript 'b' indicates significance at 5% level.

Source: Own computation.

Table 3. Test results with TAR model

Country	ρ_1	ρ_2	Φ stat	λ	AIC	BIC	LB(4)	LB(8)	Lags
Cameroon	-0.15	-0.39	2.92[c]	-0.149	-54.957	-47.472	0.936	0.833	1
Cent. A. rep.	-0.16	-0.58	4.06[b]	-0.151	-42.501	-36.825	0.743	0.728	0
Chad	-0.22	-0.57	8.67[b]	-0.243	21.446	28.931	0.836	0.955	1
Congo	-0.48	-0.42	6.87[b]	0.127	16.503	22.179	0.610	0.791	0
Eq. Guinea	-0.23	-0.14	2.63[c]	0.475	57.575	63.251	0.690	0.613	0
Gabon	-0.38	-0.35	5.21[b]	0.156	-12.069	-6.394	0.828	0.840	0

λ is the estimated threshold value. AIC and BIC respectively stand for Akaike and Bayesian Information Criterion. The superscript 'b' and 'c' denote rejection of the null hypothesis respectively at 5% and 10% level. Φ is the threshold cointegration test statistic. The values presented for Ljung-Box (LB) test are the p-values. The lag length used was selected using AIC.

Source: Own computation.

Table 4. Test results with Momentum TAR model

Country	ρ_1	ρ_2	Φ stat	λ	AIC	BIC	LB(4)	LB(8)	Lags
Cameroon	-0.20	-0.61	3.36[b]	-0.102	-53.672	-46.187	0.835	0.893	1
Cent. A. rep.	-0.18	-0.69	4.51[b]	-0.150	-41.566	-35.953	0.878	0.777	0
Chad	-0.35	-0.54	7.41[b]	-0.154	23.429	30.914	0.818	0.946	1
Congo	-0.53	-0.30	7.13[b]	-0.033	16.358	21.972	0.471	0.650	0
Eq. Guinea	-0.09	-0.26	3.17[c]	0.004	56.352	61.966	0.558	0.549	0
Gabon	-0.23	-0.42	5.28[b]	0.040	-11.556	-5.942	0.730	0.789	0

λ is the estimated threshold value. AIC and BIC respectively stand for Akaike and Bayesian Information Criterion. The superscript 'b' and 'c' denote rejection of the null hypothesis respectively at 5% and 10% level. Φ is the threshold cointegration test statistic. The values presented for Ljung-Box (LB) test are the p-values. The lag length used was selected using AIC.

Source: Own computation.

The results suggest therefore that imports and exports are cointegrated with asymmetric adjustment for Central Africa Republic, Chad, Congo and Gabon. This would imply that the current account deficits in those countries are sustainable. However, we need to check whether they are not only weakly sustainable. In order to check whether the sufficient condition is satisfied for strong sustainability of the current account deficits, that is, whether $\alpha_2 = 1$ in equation (10), we estimated equation (10) by OLS and used the Wald restriction coefficient test to check if α_2 is statistically equal to 1. The results are reported in Table 5 and they indicate that the estimated coefficient α_2 is statistically significant at 1% level of significance for the four countries. This suggests that although imports and exports were found to be cointegrated for Central Africa Republic, Chad, Congo and Gabon; it seems that the current account deficits are only strong sustainable for Chad and weakly sustainable for Central Africa Republic, Congo and Gabon.

Following the test for sustainability of the current account deficits in CEMAC countries done on a country by country basis using threshold cointegration test of Enders and Siklos [7], we further complement the analysis by using Pedroni [18,19] panel cointegration test to examine the sustainability of current account deficits in CEMAC area as a panel. Prior to that, panel unit root tests (IPS and Pesaran CADF) are conducted to detect the order of integration of the variables. Results in Table 6 suggest that, at 5% level of significance, exports and imports are non-stationary processes, integrated of order one, I (1).

The results in Table 7 show that both panel statistics and group mean panel statistics suggest that the null hypothesis of no cointegration can be rejected regardless of the deterministic components included (intercept or trend). There exists therefore a cointegration relationship between exports and imports in CEMAC countries, which would suggest that current account deficits are sustainable in CEMAC area. Since exports and imports are found to be cointegrated, panel dynamic OLS (DOLS) is used to estimate the long-run equation. The estimation results are presented in Table 7 and the χ^2 restriction test rejects the null hypothesis that the cointegrating coefficient is equal to 1. This suggests that current account deficits are weakly sustainable in CEMAC countries as a panel.

Table 5. Long run estimates

Country	Variable	Estimate	std. error	t-value	$F(H_0 : \alpha_2 = 1)$
Cent. Afr. Rep.	Intercept	2.610 [a]	0.842	3.098	12.72 [a]
	Imports	0.844 [a]	0.044	19.27	
Chad	Intercept	-1.459 [c]	0.863	-1.691	1.28
	Imports	1.049 [a]	0.043	24.41	
Congo	Intercept	-1.599	0.969	-1.651	30.51 [a]
	Imports	1.056 [a]	0.049	21.58	
Gabon	Intercept	-2.717 [a]	0.731	-3.716	17.65 [a]
	Imports	1.146 [a]	0.035	32.91	

The estimated long-run equilibrium equation is $x_t = \alpha_1 + \alpha_2 m_t + u_t$, where x_t and m_t are the logarithm of exports and imports respectively. $F(H_0 : \alpha_2 = 1)$ is the Wald coefficient restriction test statistic. The superscript 'a', 'b' and 'c' denote rejection of the null hypothesis respectively at 1%, 5% and 10% level.

Source: Own computation.

Table 6. Panel Unit Root test results

Im, Pesaran and Shin							
		Critical Values					
	t-bar	10%	5%	1%	W[t-bar]	P-value	Obs.
				Level data			
Exports	-1.83	-2.56	-2.67	-2.99	1.05	0.85	288
Imports	-2.31	-2.56	-2.67	-2.99	-0.39	0.35	288
				Differenced data			
Exports	-4.38	-2.56	-2.67	-2.99	-6.66	0.00	282
Imports	-5.30	-2.56	-2.67	-2.99	-9.45	0.00	282
Pesaran CADF							
	t-bar	10%	5%	1%	Z[t-bar]	P-value	Obs.
				Level data			
Exports	-1.63	-2.73	-2.84	-3.06	1.98	0.98	288
Imports	-2.93	-2.73	-2.84	-3.06	-1.63	0.05	288
				Differenced data			
Exports	-4.25	-2.73	-2.84	-3.06	-5.32	0.00	282
Imports	-4.93	-2.73	-2.84	-3.06	-7.22	0.00	282

Pesaran CADF is a unit root test in heterogeneous panels with cross-sectional dependence, suggested by Pesaran (2007). A lag of 1 was used for both IPS (Im, Pesaran and Shin) and Pesaran CADF tests.

Source: Own computation.

Table 7. Pedroni Panel Cointegration Test Results

Approach	I		II		III	
Alternative hypothesis: common AR coefficients (within-dimension)						
	Statistic	Prob.	Statistic	Prob.	Statistic	Prob.
Panel v-Statistic	3.417 [a]	0.000	2.415 [a]	0.008	4.386 [a]	0.00
Panel rho-Statistic	-3.016 [a]	0.001	-2.934 [a]	0.001	-4.618 [a]	0.00
Panel PP-Statistic	-2.347 [a]	0.009	-2.581 [a]	0.005	-4.334 [a]	0.00
Panel ADF-Statistic	-2.264 [b]	0.012	-2.283 [b]	0.011	-3.934 [a]	0.00
Alternative hypothesis: individual AR coefficients (between-dimension)						
	Statistic	Prob.	Statistic	Prob.	Statistic	Prob.
Group rho-Statistic	-2.221 [b]	0.013	-2.701 [a]	0.003	-2.106 [b]	0.017
Group PP-Statistic	-2.812 [a]	0.002	-2.629 [a]	0.004	-2.806 [a]	0.002
Group ADF-Statistic	-2.419 [a]	0.008	-1.952 [b]	0.025	-2.343 [a]	0.009
Dynamic Ordinary Least Squares						
Variable	Coefficient	Std. Error	Adjusted R^2	$\chi^2(H_0:\alpha=1)$		
Imports	1.109 [a]	0.032	0.955	11.451 [a]		

"I" indicates a model with deterministic no intercept and no trend, "II", a model with intercept but no trend, and "III", a model with deterministic intercept and trend. The superscript 'a', 'b' and 'c' denote rejection of the null hypothesis respectively at 1%, 5% and 10% level.

Source: Own computation.

However, although the use of panel data has a number of advantages over pure time series data, caution is needed when interpreting panel data results, especially when heterogeneity dimension among the cross-sections is not taken into account [5].

5. Concluding Remarks

This paper was intended to examine whether exports and imports are cointegrated for the Economic and Monetary Community of Central African countries, namely, Cameroon, Chad, Central African Republic, Congo, Gabon and Equatorial Guinea, in order to test for the sustainability of their current account deficits. Using TAR and momentum TAR models, the study adopted threshold cointegration test advanced by Enders and Siklos [7], allowing for asymmetric adjustment towards the long-run equilibrium.

The findings indicate that exports and imports are threshold cointegrated at 5% level for Central Africa Republic, Chad, Congo and Gabon. The current account deficits are only strong sustainable for Chad and weakly sustainable for Central Africa Republic, Congo and Gabon. Since the use of panel data has a number of merits over time-series data, panel cointegration test proposed by Pedroni [18,19] was also applied to test for sustainability of current account deficits. The results from panel cointegration test showed that exports and imports are cointegrated and that the cointegrating coefficient is statistically equal less than 1, which would imply that current account deficits are weakly sustainable in CEMAC area. However, as Dumitrescu and Hurlin [5] point out, caution is needed when interpreting panel data results, especially when heterogeneity dimension among the cross-sections is not taken into account.

In summary, the findings suggest that Cameroon and Equatorial Guinea are in violation of their international budget constraints and should therefore put in place policies to reduce their current account deficits in order to regain their external stability. For the other country members of CEMAC, Central Africa Republic, Congo and Gabon, where sustainability was found to be weak, they should also implement policies to reinforce the sustainability of the current account deficits.

References

[1] Arcade, N. and L.A. Esther (2014). "Are current Account deficit sustainable in EAC ountries? Evidence from Threshold cointegration" *Economics Bulletin* 34, 1990-2001.

[2] Balke, N.S. and T.B. Fomby (1997). "Threshold Cointegration" *International Economic Review* 38, 627-645

[3] Chan, K.S. (1993). "Consistency and Limiting Distribution of the Least Squares Estimator of a Threshold Autoregressive Model" *The Annals of Statistics* 21, 520-533.

[4] Dickey, D. A. and Fuller, W. A. (1981). "Likelihood ratio statistics for autoregressive time-series with a unit root", *Econometrica*, 49, 1057-1072.

[5] Dumitrescu, E. and C. Hurlin (2012). "Testing for Granger non-causality in heterogeneous panels" *Economic Modelling* 29, 1450-1460.

[6] Enders, W. and C.W.F. Granger (1998). "Unit-Root Tests and Asymmetric Adjustment with an Example Using the Term Structure of Interest Rates" *Journal of Business & Economic Statistics* 16, 304-311.

[7] Enders, W. and P.L. Siklos (2001). "Cointegration and Threshold Adjustment", *Journal of Business and Statistics* 19, 166-176.

[8] Engle, R.F. and C.W.J. Granger (1987). "Co-integration and Error Correction: Representation, Estimation, and Testing" *Econometrica* 55, 251-276.

[9] Hakkio, C.S. and M. Rush (1991). "Is The Budget Deficit 'Too Large?" *Economic Inquiry* 29, 429-445.

[10] Herzer, Dierk and Nowak-Lehmann D., Felicitas (2005). "Are exports and imports of Chile cointegrated?" Ibero America Institute for Economic Research, Discussion papers number 111.

[11] Husted, S. (1992). "The Emerging U.S. Current Account Deficit in the 1980s: A Cointegration Analysis" *Review of Economics and Statistics* 74, 159-166

[12] Im, K.S., Pesaran, H.M. and Y. Shin (2003). "Testing for Unit Roots in Heterogeneous Panels" *Journal of Econometrics* 115, 53-74.

[13] Johansen, S. and K. Juselius (1990). "Maximum Likelihood Estimation and Inference on Cointegration with Applications to Demand for Money" *Oxford Bulletin of Economics and Statistics* 52, 169-210.

[14] Milesi-Ferretti, G.M., Razin, A. (1996). "Sustainability of Persistent Current Account Deficits", *NBER Working Paper*, No. 5467.

[15] Mukhtar, T. and S. Rasheed (2010). "Testing Long Run Relationship between Exports and Imports: Evidence from Pakistan" *Journal of Economic Cooperation and Development* 31, 41- 58.

[16] Narayan, P.K. and S. Narayan (2005). "Are Exports and Imports Cointegrated? Evidence from 22 Least Developed Countries" *Applied Economics Letters* 12, 375-378.

[17] Pesaran, M.H. (2007). "A Simple Panel Unit Root Test in the Presence of Cross-Section Dependence" *Journal of Applied Econometrics* 22, 265-312.

[18] Pedroni, P. (1999). "Critical Values for Cointegration Tests in Heterogeneous Panels with Multiple Regressors" *Oxford Bulletin of Economics and Statistics* 61, 653-670.

[19] Pedroni, P. (2004). "Panel Cointegration: Asymptotic and Finite Sample Properties of Pooled Time Series Tests with an Application to the PPP Hypothesis" *Econometric Theory* 20, 597-625.

[20] Rahman, M.Z. (2011). "Existence of Export-Import Cointegration: A Study on Indonesia and Malaysia" *International Business Research* 4, p.108

[21] Roubini, N., Wachtel, Paul (1999). "Current-Account Sustainability in Transition Economies" IN: *Balance of Payments, Exchange Rates, and Competitiveness in Transition Economies*, Kluwer Academic Publishers, pp. 19-93

[22] Serdar, O. (2008). "The Sustainability of Current Account Deficits and Tourism Receipts in Turkey" *The International Trade Journal* 22, 39-62.

[23] Stigler, M. (2012). "Threshold Cointegration: Overview and Implementation in R", Vignette (tsDyn), R package version 0.8-1, Revision 4.

[24] Sun, C. (2011). "Price Dynamics in the Import Wooden Bed Market of the United States" *Forest Policy and Economics* 13, 479-487

[25] Tiwari, A.K. (2012). "Reassessment of Sustainability of Current Account Deficit in India" *South-Eastern Europe Journal of Economics* 1, 67-79

[26] Yol, M.A. (2009). "Testing the Sustainability of Current Account Deficits in Developing Economies: Evidence from Egypt, Morocco and Tunisia" *The Journal of Developing Areas* 43, 177-197.