Assessing the Current Account Sustainability in ECCAS economies: A Dual Cointegration Analysis

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Assessing the Current Account Sustainability in ECCAS economies: A Dual Cointegration Analysis

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Abstract:
This paper examines the sustainability of the current account deficits in eight Economic Community of Central African States (ECCAS). The empirical investigation rely on both panel and Intra-panel approach to test for long-run relationship between variables. Furthermore, non-linearity as well as asymmetric adjustment of Enders and Siklos (2001) is taken into account in cointegration analysis. Results from panel analysis show that; although exports and imports are cointegrated, the current account deficits is weakly sustainable in ECCAS over the period 1970 to 2015. These results also hold in each country's analysis. Therefore, these eight ECCAS countries should implement policies to reinforce the sustainability of the current account deficits.
Keywords: Current account, Sustainability, ECCAS, Threshold Cointegration
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1 Introduction

Current account imbalances and its sustainability is one of the controversial and important issues in macroeconomics over the past two decades. The large global current account imbalances due to the ongoing integration of the world economy raised the fundamental question of their sustainability. The concept of current account sustainability has long been the focus of policy debate and research in economics (Chen, 2011). The basic idea is appealing as it amounts to analysing whether a country is able to meet its long-run inter-temporal budget constraint without incurring episodes of painful and fast adjustment (Chen, 2011; Christopoulos and León-Ledesma, 2010; Taylor, 2002; Lanzafame, 2014). Therefore, current account for a country reflects its economic performance because of how it is considered as an important indicator for assessing growth by both investors and policy makers (Baharumshah et al., 2003; Roubini and Wachtel, 1999; Rinaldi et al., 2014; Sahoo et al., 2016; Tiwari, 2015).

Whether or not a current account deficit is sustainable has important implications for economic policy. If a country current account deficits is sustainable, then it implies that the government should have no incentive to default on its international debt (Chen, 2011). However, temporary current account deficits are not considered necessarily harmful since they show the reallocation of capital to countries where capital is more productive as noted by Wu et al. (1996). Conversely, Hakkio (1995) sustains that persistent current account deficits tend to have certain harmful effects on the domestic economy. Deficits impose an excessive burden on future generations, who will have to pay back high amounts of accumulated external debts and hence face lower standards of living.

Overwhelming amount of literature have been devoted to current account sustainability around the world, resulting in mixed conclusions depending on the countries, the sample, and the methodological approach. For instance, a number of studies have examine the sustainability of current account at the individual country level (Aizenman and Sun, 2010; Apergis et al., 2000; Christopoulos and León-Ledesma, 2010; Clarida, 2006; Husted, 1992; Karunaratne, 2010; Rinaldi et al., 2014; Tiwari, 2015; Ventosa-Santaulauria et al., 2013), as well as for a group of countries (Baharumshah et al., 2005; Chang et al., 2012; Chen, 2011; Donoso and Martin, 2014; Gnimassoun and Coulibaly, 2014; Roubini and Wachtel, 1999; Kim et al., 2009; Lanzafame, 2014; Sahoo et al., 2016). Moreover, while some studies have concluded on the unsustainability of current account (Sahoo et al., 2016) in the case of India; Rahman (2011) in the case of Indonesia, Kumar Narayan* and Narayan (2005) in the case of 22 less developed countries; Dulger and Ozdemir (2005), Engel and Rogers (2006) and Chen (2011) in the case of United States, amongst others, most studies have concluded that current account is sustainable.

Surprisingly, a bulk of literature have focused on the developed economies in the analysis of current account sustainability and developing countries have attracted less attention with the exception of Asian countries (Donoso and Martin, 2014; Gnimassoun and Coulibaly, 2014; Sahoo et al., 2016). To our best knowledge, studies focusing on the Economic Community of Central African States (hereafter ECCAS) countries are scarce. Thus this study is an attempt to examine the sustainability of the current account deficits in ECCAS economies over the period 1970 to 2015. In fact, these economies are generally characterized by a lack of credibility which makes external financing more difficult and costly (i.e. subject to a high-risk premium). They also have few sources of revenue, due to highly specialized exports (generally commodities) and a strong exposition to both internal and external shocks, which prevents many of them from honouring their commitments. So, many of these countries are facing problems of high external debt.

Particularly, this paper contributes to the existing literature by assessing the current account sustainability in the case of 8 economies of the Central Africa community namely Burundi, Cameroon, Central African Republic, Chad, Democratic Republic of Congo, Republic of Congo, Gabon and Rwanda We apply panel and individual cointegration tests to examine time series properties and long run relationship between variables. Even though several studies have adopted the univariate unit root testing approaches in order to examine the sustainability hypothesis, there has been a growing attention to assess the sustainability hypothesis by investigating the long run equilibrium relationship between the exports and imports variables. Holmes et al. (2011) reveal that the presence of long run relationship between exports and imports is a necessary condition for current account sustainability.
Thus, this study applies two linear cointegration tests: the panel cointegration test developed by Westerlund (2007) for the group of countries and the individual cointegration test proposed by Johansen (1988). However, Donoso and Martin (2014) have noted that, misclassifying a stable nonlinear process as nonstationary can be misleading to the debate on current account sustainability. Traditional unit root and cointegration tests may lead to erroneously accepting no sustainability as it's suffer from a loss of power. Furthermore, a nonlinear model may outperform the linear models in terms of forecast performance as noted by Christopoulos and León-Ledesma (2010). Since the previous cointegration tests assume symmetric adjustment and linear cointegration test, this study also implement Enders and Siklos (2001) threshold cointegration test to entail asymmetric adjustment and non-linearity in cointegration analysis.

The rest of the paper is organized as follows. Section 2 presents the theoretical background relying on the current account sustainability literature. Section 3 describes data and econometric methodologies. Section 4 focuses on the estimation results, their robustness and their interpretations. Section 5 concludes the paper.

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 (1991) and Husted (1992).
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 eq. (1) yields expression (2) where the trade balance $(X - MM)_t = Y_t - C_t - I_t$ and ω_t is the discounting factor:

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

To get a testable equation, Husted (1992) makes the following assumption where $W_t = MM_t + (r_t - r)$ 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 (1992) assumes further that expenditure on imports and exports are non-stationary processes which can be written as:

$$W_t = \theta_1 + W_{t-1} + \varrho_{1t} \tag{5}$$

$$X_t = \theta_2 + X_{t-1} + \varrho_{2t} \tag{6}$$

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

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

By letting $B = [(1+r)/r](\theta_1 - \theta_2)$ and $\varrho_t = \sum_{j=0}^{\infty} \lambda^{j-1}(\varrho_{1t} - \varrho_{2t})$, equation (7) can be written as:

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

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

$$X_t = \beta + \delta M_t + \varrho_t \tag{9}$$

According to Hakkio and Rush (1991) and Husted (1992), 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 (see for example, Herzer et al. (2005), Ongan (2008), Rahman (2011) and Tiwari (2015)

3 Econometric Methodology

3.1 Panel Unit Root Tests

The study of unit roots has played an increasingly important role in empirical analysis of data. It is well know that unit root tests have generally low power in sample sizes to distinguish integrated series from stationary series. And to increase the number of observations a solution is to add information relating to individuals or countries. Thus, the use of panel data allows to solve the low power issue of unit root tests in small samples by increasing the number of observations.

In this paper we use Maddala and Wu (1999) panel unit root test for first generation tests and Pesaran (2007) for second generation tests.

3.1.1 Maddala and Wu (1999) and Choi (2001)

Maddala and Wu (1999), one of first generation of panel unit root tests, is based on the cross-sectional independence assumption. They started with the following equation:

$$\Delta y_{i,t} = \alpha_i + \rho_i y_{i,t-1} + \sum_{z=1}^{p_i} \beta_{i,z} \Delta y_{i,t-z} + \epsilon_{i,t} \tag{10}$$

and test the $H_0 : \rho_i = 0$ for all $i = 1, \ldots, N$ against the alternative hypothesis $H_1 : \rho_i < 0$ for $i = 1, \ldots, N_1$ and $\rho_i = 0$ for $i = N_1 + 1, \ldots, N$, with $0 \leq N_1 \leq N$. The idea of the Fisher type test is very simple. Consider pure time series unit root test statistics. If these statistics are continuous, the corresponding $p-values$, denoted p_i, are uniform $(0, 1)$ variables. So, under the crucial assumption of cross-sectional independence, the statistic proposed by Maddala and Wu definded as:

$$P_{MW} = -2 \sum_{i=1}^{N} \log(p_i) \tag{11}$$

has a χ^2 distribution with $2N$ degrees of freedom, when T tends to infinity and N is fixed. For large N samples, Choi (2001) proposes a similar standardized statistic: $\log(p_i)$

$$Z_{MW} = \frac{\sqrt{N}(N^{-1}P_{MW} - E[-2\log(p_i)])}{\sqrt{var[-2\log(p_i)]}} = -\frac{\sum_{i=1}^{N}\log(p_i) + N}{\sqrt{N}} \tag{12}$$

This statistic corresponds to the standardized cross-sectional average of individual p-values. Under the cross-sectional independence assumption, the *Lindberg-Levy* theorem is suc cient to show that it converges to a standard normal distribution under the unit root hypothesis

3.1.2 The Pesaran Tests

The second generation unit root tests relax the cross-sectional independence assumption. The issue is to specify these cross-sectional dependencies. This specification is not obvious since individual observations in a cross-section have no natural ordering, except if we consider a metric of economic distance.

Pesaran (2007), one of them, proposes a different approach to deal with the problem of cross-sectional dependencies. He considers a one-factor model with heterogeneous loading factors for residuals. However, instead of basing the unit root tests on deviations from the estimated common factors, he augments the standard Dickey-Fuller or Augmented Dickey-Fuller regressions with the cross section average of lagged levels and first-differences of the individual series. If residuals are not serially correlated, the regression used for the ith country is defined as:

$$\Delta y_{i,t} = \alpha_i + \rho_i y_{i,t-1} + c_i \bar{y}_{t-1} + d_i \Delta\bar{y}_t + \nu_{i,t} \tag{13}$$

where $\bar{y}_{t-1} = (1/N)\sum_{i=1}^{N} y_{i,t-1}$ and $\Delta\bar{y}_t = (1/N)\sum_{i=1}^{N}\Delta y_{i,t}$. By denoting $t_i(N,T)$ the t-statistic of the ordinary least squares (OLS) estimate of ρ_i. The Pesaran's test is based on these individual cross-sectionally ADF statistics, denoted CADF. The idea behind is to build a modified version of IPS (Im, Pesaran and Shin) t-bar test based on the average of individual CADF statistics

$$CIPS = \frac{1}{N}\sum_{i=1}^{N} t_i(N,T) \tag{14}$$

All the individual CADF statistics have similar asymptotic null distributions which do not depend on the factor loadings. But they are correlated due to the dependence on the common factor. Therefore, it is possible to build an average of individual CADF statistics, but standard central limit theorems do not apply to these CIPS statistics. Pesaran shows that, even if it is not normal, the null asymptotic distribution of the truncated version of the CIPS statistic exists and is free of nuisance parameter. He proposes simulated critical values of CIPS for various samples sizes. Pesaran also uses Fisher type tests based on the significant levels of individual CADF statistics, as those proposed by Maddala and Wu (1999) or Choi (2001). Given the reasons mentioned above, such statistics do not have standard distributions. Finally, this approach readily extends to serially correlated residuals.

For an $AR(p)$ error specification, the relevant individual CADF statistics are computed from a p^{th} order cross-section/time series augmented regression:

$$\Delta y_{i,t} = \alpha_i + \rho_i y_{i,t-1} + c_i \bar{y}_{t-1} + \sum_{j=0}^{p} d_{i,j} \Delta \bar{y}_{t-j} + \sum_{j=0}^{p} \beta_{i,j} \Delta y_{i,t-j} + \nu_{i,t} \tag{15}$$

3.2 The Westerlund ECM cointegration tests

Westerlund (2007) developed four new panel cointegration tests that are based on structural rather than residual dynamics and, therefore, do not impose any common-factor restriction. The idea is to test the null hypothesis of no cointegration by infering whether the error-correction term in a conditional panel error-correction model is equal to zero. The new tests are all normally distributed and are general enough to accommodate unit-specific short-run dynamics, unit-specific trend and slope parameters, and cross-sectional dependence. Two tests are designed to test the alternative hypothesis that the panel is cointegrated as a whole, while the other two test the alternative that at least one unit is cointegrated.

$$\Delta y_{it} = \delta_i' d_t + \alpha_i (y_{i,t-1} - \beta_i' x_{i,t-1}) + \sum_{j=1}^{p_i} \alpha_{ij} \Delta y_{i,t-j} + \sum_{j=-q_i}^{p_i} \gamma_{ij} \Delta x_{i,t-j} + e_{it} \tag{16}$$

α_i provides an estimate of the speed of error-correction towards the long run equilibrium $y_{it} = -(\beta_i'/\alpha_i) x_{it}$ for that series i. Westerlund (2007) computes the following 04 statistics

$$G_\tau = \frac{1}{N} \sum_{i=1}^{N} \frac{\hat{\alpha}_i}{se(\hat{\alpha}_i)} \tag{17}$$

$$G_\alpha = \frac{1}{N} \sum_{i=1}^{N} \frac{T\hat{\alpha}_i}{\hat{\alpha}_i(1)} \tag{18}$$

$$P_\tau = \frac{\hat{\alpha}}{se(\hat{\alpha})} \tag{19}$$

$$P_\alpha = T\hat{\alpha} \tag{20}$$

The G_α and G_τ test statistics test $H_0 : \alpha_i = 0$ for all i versus $H_1 : \alpha_i < 0$ for at least one i. These statistics start from a weighted average of the individually estimated α_i's and their t-ratio's, respectively. The P_α and P_τ test statistics pool information over all the cross-sectional units to test $H_0 : \alpha_i = 0$ for all i versus $H_1 : \alpha_i < 0$ for all i. Rejection of H_0 should therefore be taken as rejection of cointegration for the panel as a whole.
The tests are very flexible and allow for an almost completely heterogeneous specification of both the long- and short-run parts of the error-correction model, where the latter can be determined from the data. The series are allowed to be of unequal length (see, Westerlund, 2007, for more details).

3.3 Country Analysis

3.3.1 Linear cointegration: The Johansen Cointegration

The focus variables in this study are annual exports and imports of goods and services in each country of ECCAS. If both series appear to have a unit root, then it is appropriate to conduct cointegration analysis to evaluate their interaction. The Johansen approach is a multivariate generalization of the Dickey–Fuller test (Johansen (1988); Johansen and Juselius (1990)). It concentrates on the relationship between the rank of a matrix and its characteristic roots in a vector autoregression. The Johansen approach starts with a vector autoregressive model and then reformulates it into a vector error correction model as follows:

$$H_t = \pi_1 H_{t-1} + \cdots + \pi_K H_{t-K} + \epsilon_t \tag{21}$$

$$\Delta H_t = \sum_{i=1}^{K-1} \Gamma_i \Delta H_{t-i} + \cdots + \Pi H_{t-K} + \epsilon_t \tag{22}$$

where $H_t' = (x_t, m_t)$ is a vector -in logarithm- of exports (x_t) and imports (m_t), K the maximum lag and ϵ_t the error term.
The relationship among the coefficients for the two equation is $\Gamma_i = -I + \sum_j^i \pi_j$ and $\Pi = -I + \sum_h^K \pi_h$ where I is an identity matrix.
Two type of tests i.e., the *trace* and *maximum eigenvalue* statistics, can be used to detect the number of cointegrating vectors.

3.3.2 Nonlinear cointegration: The Threshold Cointegration

Threshold cointegration technique initiated by Enders and Granger (1998) and Enders and Siklos (2001) 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 and Granger (1987) linear cointegration test, Enders and Granger (1998) and Enders and Siklos (2001) 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 (see Stigler, 2012). Let and be the logarithm of exports and imports respectively. Using TAR and M-TAR models, Enders and Siklos (2001) propose the following steps to test for threshold cointegration. In the first step, the following long-run equilibrium relationship is estimated:

$$x_t = \alpha_0 + \alpha_1 m_t + \varrho_t \tag{23}$$

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

$$\Delta \hat{\varrho}_t = I_t \rho_1 \hat{\varrho}_{t-1} + (1 - I_t)\rho_2 \hat{\varrho}_{t-1} + \sum_{i=1}^{p} \varphi_i \Delta \hat{\varrho}_{t-i} + \eta_t \tag{24}$$

where $\hat{\varrho}_t$ is the residuals series from equation (23) and I_t is the Heaviside indicator function such that:

$$I_t = \begin{cases} 1 & \text{if } \hat{\varrho}_t \geq \tau \\ 0 & \text{if } \hat{\varrho}_t < \tau \end{cases} \tag{25}$$

$$I_t = \begin{cases} 1 & \text{if } \Delta\hat{\varrho}_t \geq \tau \\ 0 & \text{if } \Delta\hat{\varrho}_t < \tau \end{cases} \tag{26}$$

Where τ is the threshold value to be estimated. Equations (24) and (25) together form the threshold autoregressive model (TAR) and equations (24) and (25) form the momentum threshold autoregressive model (M-TAR). The threshold value is selected using Chan (1993) method where the optimum value is such that the residuals sum of squares is at a minimum (Sun, 2011). From equation (24), to test for threshold cointegration, Enders and Granger (1998) 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 (2001).

3.3.3 Asymmetric ECM with threshold cointegration

The Granger representation theorem (Engle and Granger, 1987) states that an error correction model can be estimated where all the variables in consideration are cointegrated. The specification assumes that the adjustment process due to disequilibrium among the variables is symmetric. Two extensions on the standard specification in the error correction model have been made for analyzing asymmetric transmission across exports and imports. Granger and Lee (1989) first extend the specification to the case of asymmetric adjustments. Error correction terms and first differences on the variables are decomposed into positive and negative components. This allows detailed examinations on whether positive and negative differences have asymmetric effects on the dynamic behavior of our variables. The second extension follows the development of threshold cointegration (Balke and Fomby, 1997; Enders and Granger, 1998). When the presence of threshold cointegration is validated, the error correction terms are modified further. The following asymmetric error correction model with threshold cointegration is developed in this study:

$$\Delta m_t = \theta_m + \delta_m^+ E_{t-1}^+ + \delta_m^- E_{t-1}^- + \sum_{j=1}^{J} \alpha_{mj}^+ \Delta m_{t-j}^+ + \sum_{j=1}^{J} \alpha_{mj}^- \Delta m_{t-j}^-$$
$$+ \sum_{j=1}^{J} \beta_{mj}^+ \Delta x_{t-j}^+ + \sum_{j=1}^{J} \beta_{mj}^- \Delta x_{t-j}^- + \upsilon_{mt} \quad (27)$$
$$\Delta x_t = \theta_x + \delta_x^+ E_{t-1}^+ + \delta_x^- E_{t-1}^- + \sum_{j=1}^{J} \alpha_{xj}^+ \Delta m_{t-j}^+ + \sum_{j=1}^{J} \alpha_{xj}^- \Delta m_{t-j}^-$$
$$+ \sum_{j=1}^{J} \beta_{xj}^+ \Delta x_{t-j}^+ + \sum_{j=1}^{J} \beta_{xj}^- \Delta x_{t-j}^- + \upsilon_{xt} \quad (28)$$

Where Δx and Δm are respectively exports and imports in first difference, θ, δ, α and β are coefficients, and υ is error terms. All the lagged variables in first difference are split into positive and negative components, as indicated by the superscripts + and . For instance, Δx_{t-1}^+ is equal to $(x_{t-1} - x_{t-2})$ if $x_{t-1} > x_{t-2}$ and equal to 0 otherwise; Δx_{t-1}^- is equal to $(x_{t-1} - x_{t-2})$ if $x_{t-1} < x_{t-2}$ and equal to 0 otherwise.
The maximum lag J is chosen with the AIC statistic and Ljung–Box Q test so the residuals have no serial correlation. The error correction terms E, defined as $E_{t-1}^+ = I_t \hat{\mu}_{t-1}$ and $E_{t-1}^- = (1 - I_t)\hat{\mu}_{t-1}$ are constructed from the threshold cointegration regressions in Eqs.(13), (14a) and (14b). Note that this definition of the error correction terms not only considers the possible asymmetric price in response to positive and negative shocks to the deviations from long-term equilibrium, but also incorporates the impact of threshold cointegration through the construction of Heaviside indicator in Equation (24), (25) and (26).

Furthermore, single or joint hypotheses can be formally formed. In this study, four types of hypotheses and F-tests are examined. The first one is Granger causality test. Whether exports Granger causes itself or imports can be tested by restricting all exports to be zero and then employing a F-test ($H_0 : \alpha_1^+ = \alpha_1^- = 0$ for all lags i simultaneously). Similarly, the test can be applied to the imports ($H_0 : \beta_1^+ = \beta_1^- = 0$ for all lags).
The second type of hypothesis is concerned with the distributed lag asymmetric effect. At the first lag, for instance, the null hypothesis is that the exports has symmetric effect on itself and imports in each country ($H_0 : \alpha_1^+ = \alpha_1^-$). This can be repeated (i.e.,$H_0 : \beta_1^+ = \beta_1^-$). Finally, the equilibrium adjustment path asymmetry can be examined with the null hypothesis of $H_0 : \delta_1^+ = \delta_1^-$ for each equation.

4 Data Description

Our analysis uses annual data on 8 ECCAS countries from 1970 to 2015 (T=46), gathered from World Development Indicator (WDI) 2017. We collected information on exports of goods and services, imports of goods and services and Interest payments on external debt expressed in current US Dollar. Table 1 presents descriptive statistics of exports X_t and imports plus interest payments on external debt M_t (in logarithm) by country. As we see,

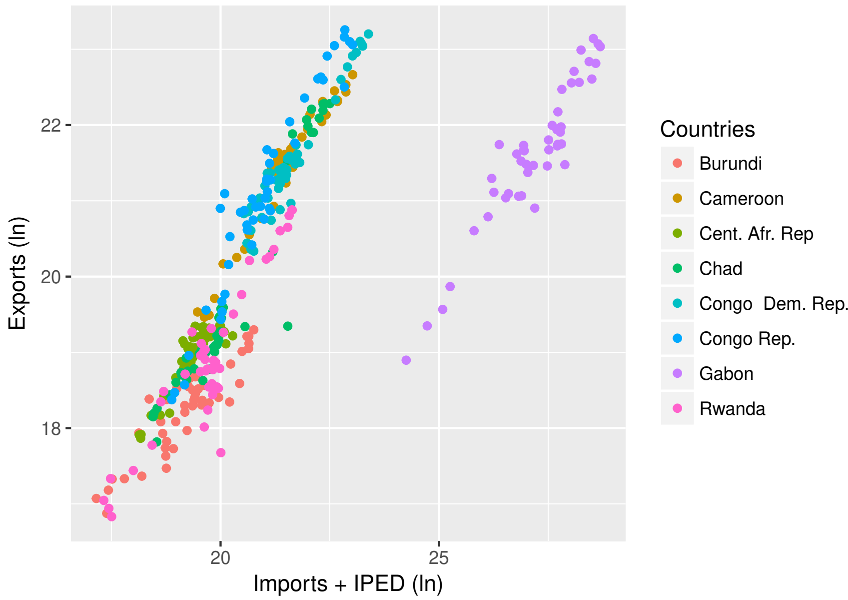

Figure 1: Export and Import plus interest payments on external debts in ECCAS

mean (respectively, standard deviation, minimum and maximum) of exports and imports by country are close to each other. And Figure 1 plots the evolution of exports in function of imports in ECCAS economies. All countries have the same trend and almost are regrouped in the same cloud. Thus, there seems to be a relationship between exports and imports.

After a preliminary exploratory data analysis, our empirical study will have two consecutive approaches: we first check if the current account is -strong or weak- sustainable in panel analysis (this goes through an analysis of panel nonstationarity, followed by a panel cointegration test); and if our variables are (panel) linked in the long-run, we check if this sustainability hold in each ECCAS country by an intra-panel-analysis.

5 Empirical Investigations

5.1 Panel Analysis

Table 2 reports the results of panel unit root tests of our variables in levels and in their first differences (in brackets).
The first two columns of Table 2 reports the Maddala and Wu (1999) χ^2 statistic for the logarithm of our variables when the regression has only an intercept (column 1) and when the regression has a linear trend (column 2) for lags 0, 1, 2 and 3. Interestingly, in both cases, all the variables (in level) considered reject the panel unit root hypothesis with the exception of imports at lag 3. And, when our variables are in first difference, we can reject at 5% the null hypothesis which means that exports and imports are stationary in first difference or $I(1)$.

Table 1: General Descriptive Statistics in ECCAS

	Mean	St dev	Min	Max	Skewness	Kurtosis	T
Burundi							
Exports	18.259	0.591	16.876	19.297	-0.417	-0.461	46
Imports	19.246	0.914	17.162	20.764	-0.359	-0.350	46
Cameroon							
Exports	21.410	0.806	19.465	22.664	-0.927	0.300	46
Imports	21.512	0.843	19.489	23.039	-0.531	0.095	46
Central African Republic							
Exports	18.963	0.414	17.866	19.348	-1.428	0.932	46
Imports	19.389	0.508	18.146	20.281	-0.786	0.262	46
Chad							
Exports	19.783	1.430	17.818	22.283	0.795	-0.999	46
Imports	20.293	1.251	18.459	22.509	0.466	-1.142	46
Congo Democratic Republic							
Exports	21.514	0.772	20.336	23.202	0.847	-0.209	46
Imports	21.657	0.800	20.561	23.395	0.809	-0.381	46
Congo Republic							
Exports	21.096	1.298	18.375	23.256	-0.181	-0.614	46
Imports	21.063	1.080	18.902	23.025	0.067	-0.635	46
Gabon							
Exports	21.626	0.950	18.897	23.142	-0.740	0.682	46
Imports	27.193	1.039	24.250	28.693	-0.829	0.351	46
Rwanda							
Exports	18.920	1.034	16.832	20.881	0.131	-0.410	46
Imports	19.777	1.089	17.329	21.651	-0.417	0.070	46

When we take into account for cross-country dependence in panel unit root test (Westerlund, 2007), the results seem different. Indeed, when we analyse our variables in level, CIPS test reject the panel unit root hypothesis for imports at lag 0, 1 (no trend case) and 0, 1, 2, 3 (trend case). And when we use exports and imports in first difference, CIPS test reject the null hypothesis in all cases at all lags.
Since we only have 8 countries, we believe that Maddala and Wu (1999) unit root tests give more reliable inference than those that does account for cross-section dependence, and we conclude that the variables under study are nonstationary.

To investigate the sustainability of current accounts in ECCAS, we rely on the cointegration tests proposed by Westerlund (2007). The authors considers three types of models: a model with no constant and no trend, a model with constant and a model with both constant and trend. The results are summarized in Table 3 below. The four test statistics proposed by Westerlund (2007) strongly reject the null hypothesis of no cointegration between exports and imports plus interest payments on external debt. This finding remains valid whether we consider model with constant and model with trend; Westerlund (2007) test indicating that current accounts in ECCAS countries have been globally sustainable over the 1970-2015

Table 2: Panel unit root tests

		Maddala and Wu		Pesaran	
	Lag	No trend	Trend	No trend	Trend
exports	0	23.558	12.719	-1.466	-1.376
		[331.79*]	[293.389*]	[-13.27*]	[-13.114*]
	1	24.314	13.041	-0.104	-0.436
		[139.265*]	[118.387*]	[-9.355*]	[-9.048*]
	2	31.79*	19.499	0.366	-0.235
		[69.526*]	[51.093*]	[-6.188*]	[-5.679*]
	3	21.715	19.513	0.644	0.521
		[51.645*]	[34.441*]	[-4.81*]	[-4.411*]
imports	0	21.557	17.986	-3.433*	-4.052*
		[307.34*]	[259.398*]	[-12.776*]	[-12.419*]
	1	14.132	15.333	-1.702*	-2.336*
		[131.052*]	[101.836*]	[-10.597*]	[-9.643*]
	2	15.326	18.391	-0.961	-1.662*
		[66.093*]	[45.548*]	[-7.049*]	[-6.182*]
	3	16.073	31.889*	-1.45	-1.871*
		[50.838*]	[30.957*]	[-5.23*]	[-4.137*]

period.
We also check whether the sufficient condition is satisfied by applying Fixed effect, Random effect and Pooled estimating on the following equation $x_{it} = \alpha_0 + \alpha_1 m_{it} + \epsilon_{it}$ and used the Wald restriction coefficient test to check if α_1 is statistically equal to 1[1]. We found a significant coefficient around of $\alpha_1 = 0.9$ for fixed and random effect and $\alpha_1 = 0.45$ for pooled estimation; for all the three estimations, the Wald χ^2 test strongly reject the null hypothesis. And we conlcude that, in panel analysis, although exports and imports are cointegrated, it seems that the current account deficits is weakly sustainable in ECCAS.
Now we are going to check if this weakly sustainability hold in each ECCAS country by a country analysis.

Table 3: Westerlund ECM cointegration tests

	None			Constant			Constant and Trend		
Statistic	Value	Z-value	Prob	Value	Z-value	Prob	Value	Z-value	Prob
G_α	-2.583	-4.368	0	-2.883	-3.480	0	-3.282	-3.187	0.001
G_τ	-12.083	-5.149	0	-16.945	-5.093	0	-19.310	-3.036	0.001
P_α	-6.843	-4.626	0	-7.684	-3.610	0	-8.319	-2.681	0.004
P_τ	-11.591	-10.321	0	-16.093	-7.558	0	-17.853	-4.115	0.000

* The general null hypothesis of Westerlun is No cointegration

[1]The result was not reported but are available on request

5.2 Country Analysis

Before running the cointegration test, the variables must be tested for stationarity for each country. For this purpose, the traditional Augmented Dickey-Fuller (Dickey and Fuller, 1981) and -for robustness- the Zivot and Andrews (2002) tests are used. Results are report in Table 4 and Table 5 respectively.
As we can see from the Table 4, exports and imports variables are non-stationary when adding a drift (except for exports of Central Africa Republic), and when including an intercept and a linear trend (except for Gabon's imports). On the other hand, they are stationary when the unit root tests are applied to the first differences of these variables.
We also employed Zivot and Andrews (2002) structural break test. The Zivot and Andrews (2002) unit root test accommodates the information about the single structural break present in the data. The results are reported in Table 5. The results indicate that both the exports and imports for all the ECCAS economies are non-stationary at their levels (except for Chad's exports) in the presence of a single tructural break and stationary at first difference. In other words, all the variables are $I(1)$.
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 4: ADF Unit Root Test by Country

	Exports				Imports + IPED*			
	Level		1^{st} Diff		Level		1^{st} Diff	
	Drift	Trend	Drift	Trend	Drift	Trend	Drift	Trend
Burundi	-2.009	-1.936	-5.23*	-5.206*	-1.594	-1.807	-4.068*	-4.091*
Cameroon	-2.735	-2.501	-3.889*	-4.261*	-1.896	-2.121	-4.181*	-4.287*
Cent. Afr. Rep.	-3.121*	-2.123	-4.519*	-5.384*	-2.268	-2.34	-4.244*	-4.314*
Chad	-0.759	-2.112	-4.552*	-4.496*	-0.766	-2.084	-4.177*	-4.098*
Congo Dem. Rep.	-0.518	-1.307	-5.741*	-5.699*	-0.204	-1.001	-5.922*	-5.954*
Congo Rep.	-2.047	-2.333	-3.888*	-4.104*	-1.298	-2.268	-4.637*	-4.592*
Gabon	-2.684	-3.207	-4.248*	-4.496*	-2.475	-3.656*	-4.165*	-4.341*
Rwanda	-1.083	-1.569	-3.95*	-3.899*	-1.601	-2.172	-3.618*	-3.677*

* IPED denotes Interest Payments on External Debt. * denotes significance at 5% level

Tables 5 and 6 report the results of threshold cointegration[2] test between imports and exports for the ECCAS economies, using TAR and momentum TAR models. The optimal threshold value τ minimizing the residuals sums of squares was estimated using Chan (1993) method. The estimated threshold value for each country are reported in Table 5 and Table 6. Results also indicate 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

[2] We also test linearity cointegration using Johansen eigenvalues and trace tests. And we found that in some ECCAS countries, exports and imports are not cointegrated. Results were not reported but are availables on request

Table 5: Zivot and Andrews unit root test

	Exports			Imports + IPED*		
	Level	1^{st} Diff	Break	Level	1^{st} Diff	Break
Burundi	-3.314	-8.232*	1995	-2.947	-6.52*	1995
Cameroon	-3.132	-5.776*	1973	-2.434	-7.042*	2006
Cent. Afr. Rep.	-3.597	-6.796*	1975	-2.864	-6.04*	1992
Chad	-5.231*	-7.404*	2003	-3.776	-5.482*	2001
Congo Dem. Rep.	-3.514	-7.231*	1990	-4.368	-7.38*	1991
Congo Rep.	-3.177	-4.787	1984	-3.462	-5.925*	1985
Gabon	-3.698	-6.121*	1973	-4.836	-5.516*	1985
Rwanda	-2.728	-6.213*	1991	-3.088	-5.406*	1973

* See Table 2

M-TAR models was also selected; For TAR model, out of a maximum of 7 lags, AIC selects a lag of 1 for Burundi, 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.

Table 6: Threshold cointegration with consistent TAR model

	Burundi	Cameroon	CAF.	Chad	COD	Congo	Gabon	Rwanda
ρ_1	-0.491**	-0.143	-0.338**	-0.287	-0.586***	-0.515***	-0.271*	-0.547***
	(-2.595)	(-0.863)	(-2.148)	(-1.225)	(-3.033)	(-3.005)	(-1.873)	(-2.831)
ρ_2	-0.26	-0.528**	-0.119	-0.43***	-0.633***	-0.364.	-0.512***	-0.136
	(-1.19)	(-2.666)	(-0.825)	(-3.117)	(-3.117)	(-1.62)	(-2.896)	(-1.244)
τ	-0.307	-0.155	0.156	0.247	-0.226	-0.097	-0.286	0.322
Φ	3.734	3.697	2.648	5.608	9.458	5.827	5.555	4.78
Φ Prob	0.032	0.033	0.082	0.007	0	0.006	0.007	0.013
LB(4)	0.942	0.94	0.672	0.287	0.672	0.556	0.922	0.834
LB(8)	0.986	0.89	0.869	0.549	0.526	0.757	0.714	0.7
AIC	-2.414	-56.186	-61.265	27.125	-25.564	15.946	-3.858	9.485
Lag	1	1	0	0	0	0	1	0
Obs	46	46	46	46	46	46	46	46

* Notes: ***,** and * respectively denotes significance at the 1%, 5% and 10% level

Threshold cointegration tests results based on TAR and M-TAR models indicate that the Φ test statistic cannot reject the null hypothesis of no threshold cointegration ($\rho_1 = \rho_2 = 0$) at 5% level of significance for Central Africa Republic only. Thus, the estimated TAR model for Cameroon[3] can be written as follows (standard error are in parantheses):

$$\Delta\hat{\varrho}_t = \underset{(0.165)}{-0.143} I_t \hat{\varrho}_{t-1} \underset{(0.198)}{-0.528} (1 - I_t)\hat{\varrho}_{t-1} \underset{(0.149)}{-0.171} \Delta\hat{\varrho}_{t-1} \text{ where } I_t = \begin{cases} 1 & \text{if } \hat{\varrho}_t \geq 0.155 \\ 0 & \text{if } \hat{\varrho}_t < 0.155 \end{cases}$$

[3]For space requirements, we are only reporting the estimated TAR and M-TAR models for Cameroon, the rest can be obtained upon request

Table 7: Threshold cointegration with consistent M-TAR model

Item	Burundi	Cameroon	CAF	Chad	COD	Congo Rep.	Gabon	Rwanda
ρ_1	-0.308*	-0.208	-0.451**	-0.497**	-0.69***	-0.503***	-0.33**	-0.412**
	(-1.919)	(-1.429)	(-2.301)	(-2.43)	(-4.923)	(-3.082)	(-2.37)	(-2.245)
ρ_2	-0.756**	-0.66**	-0.121	-0.352**	-0.018	-0.36	-0.439**	-0.157
	(-2.626)	(-2.492)	(-0.942)	(-2.342)	(-0.04)	(-1.372)	(-2.258)	(-1.34)
τ	-0.18	-0.086	0.105	-0.069	-0.249	-0.183	-0.235	0.159
Φ	4.563	3.696	3.092	5.694	12.12	5.69	4.949	3.417
Φ Prob	0.016	0.033	0.056	0.006	0	0.007	0.012	0.042
LB(4)	0.667	0.887	0.73	0.493	0.577	0.524	0.885	0.224
LB(8)	0.842	0.952	0.889	0.735	0.89	0.709	0.645	0.233
AIC	-3.893	-56.185	-59.759	27.284	-29.33	16.712	-2.822	12.055
Lag	1	1	0	0	0	0	1	0
Obs	46	46	46	46	46	46	46	46

* Notes: ***,** and * respectively denotes significance at the 1%, 5% and 10% level; The number in parantheses are t-student

and, the estimated M-TAR model for Cameroon can also be written as follows:

$$\Delta\hat{\varrho}_t = \underset{(0.145)}{-0.208} I_t \hat{\varrho}_{t-1} \underset{(0.264)}{-0.660} (1 - I_t)\hat{\varrho}_{t-1} \underset{(0.152)}{-0.134} \Delta\hat{\varrho}_{t-1} \text{ where } I_t = \begin{cases} 1 & \text{if } \Delta\hat{\varrho}_t \geq 0.086 \\ 0 & \text{if } \Delta\hat{\varrho}_t < 0.086 \end{cases}$$

Thus, our country analysis suggests that imports and exports are cointegrated with asymmetric adjustment for Burundi, Cameroon, Chad, Congo (Democratic Republic of), Congo, Gabon and Rwanda. This means that current account deficits in those countries are sustainable.

However, we need to check if they are also weakly sustainable as in panel analysis. Thus, we estimated equation (23) by OLS in each country (except Central African Republic) and used the Wald χ^2 restriction coefficient test to check if α_1 is statistically equal to 1. Results are reported in Table 8. In each country the W-test strongly rejects the null hypothesis of strong sustainability. Thus, as in Panel analysis the weak sustainability holds in country analysis.

Table 8: Long Run Estimation by country

	Burundi	Cameroon	Chad	COD	Congo Rep.	Gabon	Rwanda
(Intercept)	7.038***	1.252**	-2.534**	1.226.	-3.457***	-1.906.	1.654.
	(8.64)	(2.078)	(-2.634)	(1.614)	(-3.691)	(-1.577)	(1.485)
Imports	0.583***	0.937***	1.1***	0.937***	1.166***	0.865***	0.873***
	(13.79)	(33.496)	(23.238)	(26.729)	(26.248)	(19.48)	(15.535)
W-stat	190.2***	1122***	540***	714.5***	689***	379.5***	241.3***

* Notes: ***,** and * respectively denotes significance at the 1%, 5% and 10% level; The number in parantheses are t-student

Following the test for sustainability of the current account deficits in ECCAS Countries done in each country using threshold cointegration test of Enders and Siklos (2001), we further complement the analysis by applying asymmetric error correction model with threshold cointegration estimations and complete the analysis with some tests on ECM coefficients.

Table 9: Asymmetric Error Correction Model for Exports

	Burundi	Cameroon	Chad	COD	Congo Rep.	Gabon	Rwanda
c	0.007	0.103**	-0.047	0.088	0.026	0.011	0.018
	(0.099)	(2.156)	(-0.743)	(1.289)	(0.332)	(0.156)	(0.231)
α_1^+	0.141	-0.276	-0.048	-0.841**	-0.144	-0.274	0.544.
	(0.394)	(-0.823)	(-0.131)	(-2.507)	(-0.55)	(-0.916)	(1.482)
α_1^-	-0.47	-0.447	0.176	-0.462	0.115	0.072	0.036
	(-0.942)	(-0.935)	(0.292)	(-1.058)	(0.202)	(0.153)	(0.038)
β_1^+	-0.071	0.031	0.621***	0.565	0.492.	0.671**	0.081
	(-0.244)	(0.126)	(3.065)	(1.346)	(1.59)	(2.37)	(0.272)
β_1^-	-0.167	0.796.	-0.744.	0.082	-0.51	-0.422	0.005
	(-0.465)	(1.574)	(-1.671)	(0.146)	(-1.29)	(-1.106)	(0.011)
δ_1^+	-0.452**	-0.487**	-0.472**	-0.504.	-0.287	-0.3*	-0.263
	(-2.25)	(-2.356)	(-2.438)	(-1.677)	(-1.387)	(-1.868)	(-1.027)
δ_1^-	-0.452	-0.92**	-0.445**	0.29	-0.072	0.154	-0.037
	(-1.137)	(-2.427)	(-2.103)	(0.318)	(-0.262)	(0.615)	(-0.23)

* Notes: ***,** and * respectively denotes significance at the 1%, 5% and 10% level; The number in parantheses are t-student

Asymmetric error correction model with threshold cointegration results of exports are reported in Table 9
As we see, there is only one significant coefficient for Burundi (δ_1^+), three for Cameroon ($c, \delta_1^+, \delta_1^-$), one for Congo ($\delta_1^+$), two for Gabon ($\beta_1^+, \delta_1^+$), two for Congo Democratic (α_1^+, δ_1^+) and four for Chad ($\beta_1^+, \beta_1^-, \delta_1^+, \delta_1^-$).
For Cameroon[4], import's shock of the previous period have no significant effect on current exports even if these coefficients are less than zero (α_1^+, α_1^-). The point estimates of the coefficients for the error correction terms are 0.49 for positive error correction term and 0.92 for negative one. The magnitude suggests that, the short term exports respond to positive deviations by 48.7% in a year and by 92% to negative deviations. Measured in response time, positive deviations take about (2.05) two years and one month at least to be fully digested while negative deviations only take (1.09) one year.

Table 10 reports Asymmetric ECM tests for the following hypotheses: equilibrium adjustment path asymmetric effect (H_{01}), Granger causality tests (H_{02}) and (H_{03}) and distributed lag asymmetric effect (H_{04}) and (H_{05}).
The hypotheses of Granger causality between variables are assessed with F-tests. As we can see, exports granger cause at 5% imports in ECCAS economies only for Burundi and Congo Democratic; while imports granger cause export at 10% for Cameroon, Chad and

[4]the others column of Table 9 can be comment by refer to Cameroon with respect of significance and coefficient signs

Table 10: ECM asymmetric Tests

	Burundi	Cameroon	Chad	COD	Congo.Rep.	Gabon	Rwanda
$H_{01}: \delta_1^+ = \delta_1^-$	11.824***	0.258	0.087	0.002	0.058	6.473**	0.618
H_{02}: $\alpha_1^+ = \alpha_1^- = 0$	3.339**	0.178	1.427	4.016**	0.062	1.089	0.288
H_{03}: $\beta_1^+ = \beta_1^- = 0$	1.444	2.758*	2.948*	1.11	2.329.	2.25.	2.728*
$H_{04}: \alpha_1^+ = \alpha_1^-$	5.434**	0.164	2.228.	1.036	0.094	0.346	0.268
$H_{05}: \beta_1^+ = \beta_1^-$	0.119	0.093	5.892**	0.761	4.015*	4.074*	0.15

* For the hypotheses: Ho1 is about equilibrium adjustment path asymmetric effect, Ho2 and Ho3 are Granger causality tests and Ho4 and Ho5 evaluate distributed lag asymmetric effect. ***,** and * respectively denotes significance at the 1%, 5% and 10% level

Rwanda. We note that, the F-statistics of 3.34 for Burundi and 4.11 for Congo Democratic disclose that lagged imports have significant impacts on current exports in these countries. For Burundi, the statistic 3.34 coupled with 1.44, tell us that in the short term, exports of Burundi has been dependent on imports of the previous period[5].
In each country's equation, the equality of the corresponding positive and negative coefficients for lag one is tested. It turns out that four of them are significant (two at 5% and two at the 10% level). We found distributed lag asymmetric effect for Burundi (5.43), Congo (3.92), Gabon (3.93) and Chad (5.98).
The final type of asymmetry examined is the momentum equilibrium adjustment path asymmetries. We found only two significant statistics. For Burundi, with F-statistic of 11.82 and another for Gabon with 5.99.

6 Conclusion

The aim of this paper was to investigate the current account sustainability of eight ECCAS countries namely Burundi, Cameroon, Central African Republic, Chad, Congo (Democratic Republic of), Congo (Republic of), Gabon and Rwanda by testing the existence of a cointegration relationship between exports and imports plus interest payments on external debt countries over the $1970 - 2015$ period.
The conceptual framework to the analysis was provided by a simple model of current account sustainability developed by Hakkio and Rush (1991), and Husted (1992). This model supports that, if real exports and real imports (plus net transfer payments) are integrated of order one then cointegration between them is a necessary and sufficient condition for the economy/country to satisfy its intertemporal budget constraint. Mainly, the analysis focused on a dual cointegration approach in order to achieve the goal of this study (the linear cointegration and nonlinear cointegration tests). The linear approach is based on Westerlund (2007) panel cointegration test, Johansen (1988) and Johansen and Juselius (1990) individual cointegration tests. The nonlinear cointegration consists on the threshold cointegration test advanced by Enders and Siklos (2001).

[5]While in the case of Cameroon, for example, at 10% level, exports of good and services evolving independently

The individual linear cointegration tests findings suggest that the current account for eight ECCAS countries are unsustainable. Nevertheless, the results from the linear panel analysis show that although exports and imports are cointegrated, the current account deficits is weakly sustainable. On the other hand, for both TAR and M-TAR models, the findings indicated that, the null hypothesis of no threshold cointegration is rejected for all our ECCAS countries at 5% level except for Central African Republic. Imports and exports are therefore cointegrated for seven countries in our sample with threshold adjustment, whereas for Central African Republic, they are not cointegrated. Moreover, the Wald restriction test on the cointegrating coefficient reveals that the current account deficits are weakly sustainable for all countries except Central African Republic with an unsustainable current account. Therefore, these eight ECCAS countries should implement policies to reinforce the sustainability of the current account deficits. More specially, Central African Republic should therefore put in place policies to reduce its current account deficit in order to recover its external stability.

References

Aizenman, J. and Sun, Y. (2010). Globalization and the sustainability of large current account imbalances: Size matters. *Journal of Macroeconomics*, 32(1):35–44.

Apergis, N., Katrakilidis, K. P., and Tabakis, N. M. (2000). Current account deficit sustainability: the case of greece. *Applied Economics Letters*, 7(9):599–603.

Baharumshah, A. Z., Lau, E., and Fountas, S. (2003). On the sustainability of current account deficits: evidence from four asean countries. *Journal of Asian economics*, 14(3):465–487.

Baharumshah, A. Z., Lau, E., and Fountas, S. (2005). Current account deficit sustainability: A panel approach. *Journal of Economic Integration*, pages 514–529.

Balke, N. S. and Fomby, T. B. (1997). Threshold cointegration. *International economic review*, pages 627–645.

Chan, K.-S. (1993). Consistency and limiting distribution of the least squares estimator of a threshold autoregressive model. *The annals of statistics*, pages 520–533.

Chang, C.-k., Chang, T., et al. (2012). Revisiting the sustainability of current account deficit: Spsm using the panel kss test with a fourier function. *Economics Bulletin*, 32(1):538–550.

Chen, S.-W. (2011). Current account deficits and sustainability: Evidence from the oecd countries. *Economic Modelling*, 28(4):1455–1464.

Choi, I. (2001). Unit root tests for panel data. *Journal of international money and Finance*, 20(2):249–272.

Christopoulos, D. and León-Ledesma, M. A. (2010). Current account sustainability in the us: What did we really know about it? *Journal of International Money and Finance*, 29(3):442–459.

Clarida, R. H. (2006). G7 current account imbalances: Sustainability and adjustment. Technical report, National Bureau of Economic Research.

Dickey, D. A. and Fuller, W. A. (1981). Likelihood ratio statistics for autoregressive time series with a unit root. *Econometrica: Journal of the Econometric Society*, pages 1057–1072.

Donoso, V. and Martin, V. (2014). Current account sustainability in latin america. *The Journal of International Trade & Economic Development*, 23(5):735–753.

Dulger, F. and Ozdemir, Z. A. (2005). Current account sustainability in seven developed countries. *Journal of Economic and Social Research*, 7(2):47–80.

Enders, W. and Granger, C. W. J. (1998). Unit-root tests and asymmetric adjustment with an example using the term structure of interest rates. *Journal of Business & Economic Statistics*, 16(3):304–311.

Enders, W. and Siklos, P. L. (2001). Cointegration and threshold adjustment. *Journal of Business & Economic Statistics*, 19(2):166–176.

Engel, C. and Rogers, J. H. (2006). The us current account deficit and the expected share of world output. *Journal of monetary Economics*, 53(5):1063–1093.

Engle, R. F. and Granger, C. W. (1987). Co-integration and error correction: representation, estimation, and testing. *Econometrica: journal of the Econometric Society*, pages 251–276.

Gnimassoun, B. and Coulibaly, I. (2014). Current account sustainability in sub-saharan africa: Does the exchange rate regime matter? *Economic Modelling*, 40:208–226.

Granger, C. W. J. and Lee, T.-H. (1989). Investigation of production, sales and inventory relationships using multicointegration and non-symmetric error correction models. *Journal of applied econometrics*, 4(S1):S145–S159.

Hakkio, C. S. (1995). The us current account: the other deficit. *Economic Review-Federal Reserve Bank of Kansas City*, 80(3):11.

Hakkio, C. S. and Rush, M. (1991). Is the budget deficit "too large?". *Economic inquiry*, 29(3):429–445.

Herzer, D., Nowak-Lehmann, D., et al. (2005). Are exports and imports of chile cointegrated? Technical report, Discussion papers//Ibero America Institute for Economic Research.

Holmes, M. J., Panagiotidis, T., and Sharma, A. (2011). The sustainability of india's current account. *Applied Economics*, 43(2):219–229.

Husted, S. (1992). The emerging us current account deficit in the 1980s: a cointegration analysis. *The review of Economics and Statistics*, pages 159–166.

Johansen, S. (1988). Statistical analysis of cointegration vectors. *Journal of economic dynamics and control*, 12(2-3):231–254.

Johansen, S. and Juselius, K. (1990). Maximum likelihood estimation and inference on cointegration—with applications to the demand for money. *Oxford Bulletin of Economics and statistics*, 52(2):169–210.

Karunaratne, N. D. (2010). The sustainability of australia's current account deficits—a reappraisal after the global financial crisis. *Journal of Policy Modeling*, 32(1):81–97.

Kim, B.-H., Min, H.-G., Hwang, Y.-S., and McDonald, J. A. (2009). Are asian countries' current accounts sustainable? deficits, even when associated with high investment, are not costless. *Journal of Policy Modeling*, 31(2):163–179.

Kumar Narayan*, P. and Narayan, S. (2005). Are exports and imports cointegrated? evidence from 22 least developed countries. *Applied Economics Letters*, 12(6):375–378.

Lanzafame, M. (2014). Current account sustainability in advanced economies. *The Journal of International Trade & Economic Development*, 23(7):1000–1017.

Maddala, G. S. and Wu, S. (1999). A comparative study of unit root tests with panel data and a new simple test. *Oxford Bulletin of Economics and statistics*, 61(S1):631–652.

Ongan, S. (2008). The sustainability of current account deficits and tourism receipts in turkey. *The International Trade Journal*, 22(1):39–62.

Pesaran, M. H. (2007). A simple panel unit root test in the presence of cross-section dependence. *Journal of Applied Econometrics*, 22(2):265–312.

Rahman, M. Z. (2011). Existence of export-import cointegration: A study on indonesia and malaysia. *International Business Research*, 4(3):108.

Rinaldi, A., Pistoresi, B., et al. (2014). A note on italy's current account sustainability: 1861-2010. *Economics Bulletin*, 34(2):1197–1204.

Roubini, N. and Wachtel, P. (1999). Current-account sustainability in transition economies. In Skreb, M. and Blejer, M., editors, *Balance of Payments, Exchange Rates, and Competitiveness in Transition Economies*, chapter 2, pages 19–93. Kluwer Academic Publishers.

Sahoo, M., Babu, M. S., and Dash, U. (2016). Long run sustainability of current account balance of china and india: New evidence from combined cointegration test. *Intellectual Economics*, 10(2):78–91.

Stigler, M. (2012). Threshold cointegration: overview and implementation in r (revision 4).

Sun, C. (2011). Price dynamics in the import wooden bed market of the united states. *Forest Policy and Economics*, 13(6):479–487.

Taylor, A. M. (2002). A century of current account dynamics. *Journal of International Money and Finance*, 21(6):725–748.

Tiwari, A. K. (2015). Reassesment of sustainability of current account deficit in india. *South-Eastern Europe Journal of Economics*, 10(1).

Ventosa-Santaulauria, D., Gomez-Zaldivar, M., Perez, L. A., et al. (2013). Long-run relationship with shifts between mexican current account revenues and expenditures. *Economics Bulletin*, 33(2):1317–1327.

Westerlund, J. (2007). Testing for error correction in panel data. *Oxford Bulletin of Economics and statistics*, 69(6):709–748.

Wu, J.-L., Fountas, S., and Chen, S.-l. (1996). Testing for the sustainability of the current account deficit in two industrial countries. *Economics Letters*, 52(2):193–198.

Zivot, E. and Andrews, D. W. K. (2002). Further evidence on the great crash, the oil-price shock, and the unit-root hypothesis. *Journal of business & economic statistics*, 20(1):25–44.