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Prospects for a Monetary Union in the East Africa Community: Some Empirical Evidence

Abstract

This paper examines G-PPP and business cycle synchronization in the East Africa Community with the aim of assessing the prospects for a monetary union. The univariate fractional integration analysis shows that the individual series exhibit unit roots and are highly persistent. The fractional bivariate cointegration tests (see Marinucci and Robinson, 2001) suggest that there exist bivariate fractional cointegrating relationships between the exchange rate of the Tanzanian shilling and those of the other EAC countries, and also between the exchange rates of the Rwandan franc, the Burundian franc and the Ugandan shilling. The FCVAR results (see Johansen and Nielsen, 2012) imply the existence of a single cointegrating relationship between the exchange rates of the EAC countries. On the whole, there is evidence in favour of G-PPP. In addition, there appears to be a high degree of business cycle synchronization between these economies. On both grounds, one can argue that a monetary union should be feasible.

JEL-Codes: C220, C320, F330.

Keywords: East Africa Community, monetary union, optimal currency areas, fractional integration and cointegration, business cycle synchronization, Hodrick-Prescott filter.

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1. Introduction

This paper aims to assess the prospects for a monetary union in the East African Community (EAC), a group of six countries intending to achieve a common monetary policy and currency by 2024, by considering some of the conditions for an Optimal Currency Area (OCA). More specifically, it applies fractional cointegration methods to test whether Generalized Purchasing Power Parity (G-PPP) holds in the EAC. In addition, it examines business cycle synchronisation by using the Hodrick-Prescott (HP) filter to decompose GDP into trend and cyclical components and measure the degree of correlation between the latter in this set of countries. Because South Sudan joined the EAC only in April 2016, and therefore very few observations are available for this country, the analysis focuses on the other five members of the union only.

Unlike earlier studies on the EAC based on the classical I(0)/I(1) dichotomy (see, e.g., Buigut and Valev, 2005; Mafusire and Brixiova, 2013; Yabara, 2014), we adopt a fractional cointegration framework that allows for long memory in the residuals of the cointegrating relationship, and therefore for a slow dynamic adjustment towards the long-run equilibrium. Long-memory models have already been estimated in various papers testing for Purchasing Power Parity (PPP). For instance, Kaen and Koveos (1982) found evidence of long memory during the flexible exchange rate period (1973-1979), and Cheung (1993) during the managed floating regime. Baum et al. (1999) estimated ARFIMA models for real exchange rates in the post-Bretton Woods era and found no evidence to support long-run PPP. Diebold et al. (1991) and Baillie and Bollerslev (1994) reported fractional cointegration with non-stationary but mean-reverting cointegrating errors (see the survey by Gil-Alana and Hualde, 2009 for further examples).

More recent studies have employed fractional integration and cointegration to analyse OCAs (see, e.g., De Truchis and Kedadd, 2014 for the case of the ASEAN economies). In the present paper we carry out for the first time this type of analysis for the EAC and employ, among others, the recently introduced Fractionally Cointegrated VAR (FCVAR) approach proposed by Johansen and Nielsen (2012).

The structure of the paper is as follows: Section 2 provides some background information about the East African Community; Section 3 explains the relevance of Generalized Purchasing Power Parity for Optimal Currency Areas; Section 4 outlines the fractional integration and cointegration methods used; Section 5 presents the empirical results, and Section 6 offers some concluding remarks.

2. The East African Community

The East African Community (EAC) is an intergovernmental organization including the recently established nation of South Sudan and the five countries in the African Great Lakes region in Eastern Africa: Burundi, Kenya, Rwanda, Tanzania and Uganda. The organization was originally established in 1967, but collapsed in 1977 and was officially revived on 7 July 2000. In 2008, after talks with the Southern Africa Development Community (SADC) and the Common Market for Eastern and Southern Africa (COMESA), the EAC agreed to become part of a free trade area including the member states of all three, and therefore an integral part of the African Community. The EAC is also a potential precursor to the establishment of an East African Federation. In 2010 it launched its own common market for capital, goods and labour in the region, with the objective of creating a common currency union and eventually a political federation. In November 2013 a protocol was signed outlining the plans of the five member countries to launch a monetary union within ten years.

Kenya, Tanzania and Uganda have had a history of cooperation dating back to the early 20th century. The customs union between Kenya and Uganda in 1917, which the then Tanganika joined in 1927, was followed by the East African High Commission from 1948 to 1961, later by the East African Common Services Organization from 1961 to 1967, and then by the East African Community until 1977. Inter-territorial cooperation between the Kenya Colony, the Uganda Protectorate and the Tanganika Territory was first formalized in 1948 by the East African High Commission. This provided a customs union and a common external tariff. It also dealt with common services in communications, transport, research and education. After independence from Britain was obtained, these integrated activities were extended and the High Commission was replaced by the East African Common Services Organization, which many observers thought would lead to a political federation between the three territories. However, the new organization faced difficulties owing to the lack of fiscal coordination and the dominant economic position of Kenya.

In 1967 the East African Common Services Organization was superseded by the East African Community. This body aimed to strengthen ties between members through a common market, a common customs tariff and a range of public services to achieve balanced economic growth within the region. In 1999 Kenya, Tanzania and Uganda signed the Treaty for the establishment of the East African Community (EAC), which entered into force in July 2000. In 2007 the Treaty was also signed by Burundi and Rwanda, thus expanding the EAC to five countries. According to the Treaty, the EAC should first form a customs union, then a common market and a monetary union, and finally a political union. The Customs Union became operational in 2005, and was formally completed in 2010. The Common Market Protocol was signed in 2009, and there is a plan for creating a common market, including free movement of goods,

labour, persons, services and capital. Recently, in April 2016, South Sudan also joined the EAC.

The process of creating a monetary union started early, but proceeded slowly. Thus, in 2007 the EAC member countries decided to fast-track it, with the intention of signing a protocol to establish the East African Monetary Union (EAMU) in 2012; this was finally signed in 2013, while its actual implementation, initially planned to be completed by 2015, is now expected to take several years, i.e. at least until 2024. The experience of other monetary unions clearly shows that it is a complex project, with a non-negligible risk of failure, and therefore it is essential to ensure that the requirements for a successful EAMU are met.

3. Generalized Purchasing Power Parity and Optimal Currency Areas

Generalized Purchasing Power Parity (G-PPP) for m countries in a world of n countries requires that there exists a long-run equilibrium cointegration relationship between their m-1 bilateral real rates. When G-PPP holds, the real exchange rate between two countries can be expressed as a weighted average of the other real rates in the currency area. These weights reflect not only trade linkages, but also technology transfers, immigration and financial flows.

G-PPP can be interpreted in terms of an Optimum Currency Area (OCA), that is, a group of regions or countries with economies closely linked by trade in goods and services and by factor mobility for which it is ideal to adopt a single currency or a group of currencies pegged to each other and fluctuating together vis-à-vis other currencies. According to Mundell (1961), under the assumption of short-run rigidity of prices and wages and no factor mobility, a group of economies can be considered an OCA if they experience the same types of real disturbances. The volume of intra-regional trade

among members is also important: in the Heckscher-Ohlin model, if two countries are major trading partners then there will be some degree of factor price equalization. Thus, within a currency area with sufficiently linked economies, the real exchange rates will share a common stochastic trend; this implies that there should be at least one cointegrating relationship between them (see Enders and Hurn, 1994).

Various papers have already analysed the feasibility of a monetary union in the East African Community. Mafusire and Brixiova (2013) tested empirically the extent of shock synchronization among the EAC members, and concluded that, given the structural differences still existing between them, a common monetary policy would have asymmetric effects and might not be beneficial to some members. Buigut and Valev (2005) applied a two-variable SVAR model to test for correlation between shocks in the EAC countries, and on the basis of their evidence argued against the desirability of a monetary union in the EAC. Yabara (2014) investigated the dynamics of the currency markets of the EAC, and found that the exchange rates of Kenya, Tanzania and Uganda are mainly driven by shocks to their own economies, while those of Burundi and Rwanda have been increasingly affected by spillovers from the dollar and euro since the global financial crisis. Below we contribute to the literature on the EAC by using fractional cointegration methods to examine exchange rates linkages and carrying out correlation analysis for business cycle synchronization.

4. Methodology

Until the 1980s non-stationary economic and financial time series were usually modelled assuming a deterministic function of time and stationary I(0) residuals from the regression model. After the seminal work of Nelson and Plosser (1982), the consensus became that the non-stationary element of most series is stochastic, and I(1)

models with unit roots were normally specified. However, the I(0)/I(1) dichotomy is a rather restrictive assumption, since the differencing parameter required to obtain stationarity is not necessarily an integer but could be any real value as in the case of fractionally integrated or I(d) processes belonging to the long-memory category.

Long memory implies that observations which are far apart in time are highly correlated, and this property can be captured in a fractional integration framework. A fractionally integrated, or I(d) model, x_t , can be expressed in the following form:

$$(1 - L)^d x_t = u_t, \quad t = 0, \pm 1, ..., \qquad (1)$$

where d can be any real value, L is the lag-operator ($Lx_t = x_{t-1}$) and u_t is I(0), defined as a covariance stationary process with a spectral density function that is positive and finite at the zero frequency. The polynomial $(1-L)^d$ in equation (1) can be expressed in terms of its binomial expansion, such that, for all real d ,

$$(1-L)^d = \sum_{j=0}^{\infty} \binom{d}{j} (-1)^j L^j = 1 - dL + \frac{d(d-1)}{2} L^2 - \frac{d(d-1)(d-2)}{6} L^3 ...$$

and thus

$$(1-L)^d x_t = x_t - dx_{t-1} + \frac{d(d-1)}{2} x_{t-2} - \frac{d(d-1)(d-2)}{6} L^3 ...$$

In this context, d plays a crucial role since it indicates the degree of dependence of the time series. The higher the value of d is, the higher the level of association between the observations will be. Specifically, if d = 0, $x_t = u_t$, x_t is said to be characterized by “short memory” or I(0), and autocorrelation (AR) is of a “weak” form, with the autocorrelation coefficients decaying exponentially. If d > 0, x_t is said to exhibit “long memory”, so called because of the strong association between observations that are distant in time. If d belongs to the interval (0, 0.5) then x_t is still covariance stationary, while $d \geq 0.5$ implies non-stationarity. Finally, if d < 1, the series is mean-reverting, i.e. the effects of

external shocks disappear in the long run, in contrast to the case of $d \geq 1$, when they persist indefinitely.

There are several methods for estimating and testing the fractional differencing parameter d. Some of them are parametric while others are semi-parametric and can be specified in the time or in the frequency domain. In this paper we use a Whittle estimator of d in the frequency domain (Dahlhaus, 1989) along with a testing procedure based on the Lagrange Multiplier (LM) principle that also uses the Whittle function but in the frequency domain. We test the null hypothesis:

$$H_o : d = d_o , \tag{2}$$

for any real value d_o, in a model given by the equation (1), where x_t is the errors in a regression model of the form:

$$y_t = \beta^T z_t + x_t , \quad t = 1, 2, ..., \tag{3}$$

where y_t is the observed time series, β is a (kx1) vector of unknown coefficients and z_t is a set of deterministic terms that might include an intercept (i.e., $z_t = 1$), an intercept with a linear time trend ($z_t = (1, t)^T$), or any other type of deterministic processes. The LM test of Robinson (1994) is robust to a certain degree of conditional heteroscedasticity and is the most efficient method in the Pitman sense against local departures from the null (see Robinson, 1994).

The multivariate extension of the I(d) model involves the concept of fractional cointegration, which concerns the possible existence of long-run equilibrium relationships between the series of interest. Given two real numbers d, b, the components of the vector z_t are said to be cointegrated of order d, b, denoted $z_t \sim CI(d, b)$ if all the components of z_t are I(d) and there exists a vector $\alpha \neq 0$ such that $s_t = \alpha' z_t \sim I(\gamma) = I(d - b)$, $b > 0$. Here, α and s_t are called the cointegrating vector and error respectively. Below we carry out bivariate fractional cointegration tests as in Marinucci

and Robinson (2001) as well as multivariate tests as in the Fractionally Cointegrated Vector AutoRegressive (FCVAR) model introduced by Johansen (2008) and further expanded by Johansen and Nielsen (2010, 2012). This is a generalization of Johansen´s (1996) Cointegrated Vector AutoRegressive (CVAR) model which allows for fractional processes of order d with cointegrating order d-b. Consider first the well-known, non-fractional, CVAR model. Let y_t, t = 1, 2, …, T be a p-dimensional I(1) time series. The CVAR model is specified as

$$\Delta Y_t = \alpha\beta' Y_{t-1} + \sum_{i=1}^{k} \Gamma_i \Delta Y_{t-i} + \varepsilon_t = \alpha\beta' L Y_t + \sum_{i=1}^{k} \Gamma_i \Delta L^i Y_t + \varepsilon_t \qquad (4)$$

The simplest way to derive the FCVAR model is to replace the difference and lag operators Δ and L in (5) with their fractional counterparts, Δ^d and $L_b = 1 - \Delta^b$, respectively. We then obtain

$$\Delta^b Y_t = \alpha\beta' L_b Y_t + \sum_{i=1}^{k} \Gamma_i \Delta^b L_b{}^i Y_t + \varepsilon_t, \qquad (5)$$

which is applied to $Y_t = \Delta^{d-b} X_t$ such that

$$\Delta^d X_t = \alpha\beta' L_b \Delta^{d-b} X_t + \sum_{i=1}^{k} \Gamma_i \Delta^b L_b{}^i Y_t + \varepsilon_t, \qquad (6)$$

where ε_t is p-dimensional independent and identically distributed with mean zero and covariance matrix Ω. The parameters have the usual interpretations from the CVAR model. Thus, α and β are $p \times r$ matrices, where $0 \le r \le p$. The columns of β are the cointegrating relationships in the system, that is to say the long-run equilibria. The parameters Γ_i govern the short-run behaviour of the variables, and the coefficients in α represent the speed of adjustment towards equilibrium for each of the variables. The FCVAR model permits simultaneous modelling of the long-run equilibria, the adjustment responses to deviations from them and the short-run dynamics of the system.

Nielsen and Morin (2016) provide Matlab computer programmes for the estimators and test statistics.

5. Empirical Results

We employ monthly data on real exchange rates from 1990 up to 2015 obtained from the IMF's International Financial Statistics. These series are shown in Figure 1, and appear to behave rather similarly, all of them exhibiting an upward trend. Standard unit root tests suggest that none of them is characterized by I(0) stationarity (see Table 1).

[Insert Table 1 about here]

Table 2 reports the parametric estimates of d; in all cases the unit root cannot be rejected, which implies that shocks have permanent effects

[Insert Tables 2 and 3 about here]

Table 3 shows the bivariate fractional cointegration test results. In 6 out of 10 cases the null of fractional cointegration cannot be rejected. The exchange rate of the Tanzanian shilling is cointegrated with all the other exchange rates, while that of the Rwandan franc is cointegrated with those of the Burundian franc and the Ugandan shilling. By contrast, the Kenyan Shilling does not appear to be linked to the other currencies in the region. On the whole, the evidence concerning G-PPP is not conclusive.

[Insert Tables 4 and 5 about here]

Next, we estimate the FCVAR model. The null of one fractional cointegration relationship cannot be rejected (see Table 4), which suggests that G-PPP holds. The resulting VECM specification is the following:

$$\Delta^d\left(\begin{bmatrix} Burundian\_Franc \\ Kenyan\_Shilling \\ Tanzanian\_Shilling \\ Rwandan\_Franc \\ Ugandan\_Shilling \end{bmatrix} - \begin{bmatrix} 0.001 \\ 0.022 \\ 0.001 \\ 0.002 \\ 0.001 \end{bmatrix}\right) = L_d \begin{bmatrix} 1.000 \\ -0.311 \\ -1.075 \\ 2.650 \\ -4.704 \end{bmatrix} \upsilon_t + \sum_{i=1}^{2} \Gamma_i \Delta^d L_d{}^i (X_t - \mu) + \varepsilon_t .$$

The estimated coefficients imply that external shocks have opposite effects in the case of the former British territories compared to Burundi and Rwanda.

Finally, we analyse business cycle synchronization in the EAC. Specifically, we apply the Hodrick-Prescott method to decompose GDP into trend and cyclical components using annual data from the Pennworld Table for the period 1960-2014.

[Insert Figure 2 and Table 5 about here]

The results are shown in Figure 2. In all cases there is an upward trend. However, only Uganda appears to have experienced continuous growth, whilst the other countries have also gone through periods characterised by declines in GDP growth: in Ruanda this occurred following the genocide of the early 1990s; in Tanzania, after a period of buoyant growth driven by public investment in all sectors of the economy, poverty re-emerged at the beginning of the 90s; in both Kenya and Burundi the 1990s were a period of slow growth. Table 6 reports the correlations between the cyclical components for the five EAC countries analysed. Most of them are high and positive, which represents evidence in favour of the feasibility of a monetary union.

6. Conclusions

This paper examines real exchange rate linkages and business cycle synchronization in the EAC with the aim of assessing whether or not this set of countries is likely to be able to create a successful monetary union. The univariate fractional integration analysis shows that the individual series exhibit unit roots and are highly persistent. The

fractional bivariate cointegration tests (see Marinucci and Robinson, 2001) suggest that there exist bivariate fractional cointegrating relationships between the exchange rate of the Tanzanian shilling and those of the other EAC countries, and also between the exchange rates of the Rwandan franc, the Burundian franc and the Ugandan shilling. The FCVAR results (see Johansen and Nielsen, 2012) imply the existence of a single cointegrating relationship between the exchange rates of the EAC countries. On the whole, there is evidence in favour of G-PPP. In addition, there appears to be a high degree of business cycle synchronization between these economies. On both grounds, one can argue that a monetary union should be feasible. Differences in exchange rate behaviour still exist between the former British colonies relative to Burundi and Ruanda, but on the whole the EAC might qualify as an OCA. A similar approach could be used to analyse the feasibility of other currency unions in Africa such as the South African Development Community or the West African Monetary Zone.

It should be stressed, however, that a successful union also requires fiscal convergence. At present there is no evidence that this has been achieved. The EAC countries are heavily dependent on external aid flows to combat fiscal imbalances; a measure of the fiscal deficit inclusive of foreign aid would be more informative about the state of their public finances with a view to forming a monetary union. It would also be useful for the EAC countries to agree on surveillance and the enforcement mechanisms for convergence criteria. A possibility would be to give an appropriate mandate to the EAC Secretariat.

The experience of other, already existing, African monetary unions could also be informative. The West African Economic and Monetary Union (WAEMU) and the Central African Economic and Monetary Community (CEMAC) have been a monetary union with 14 countries sharing the CFA as a common currency since they gained

independence. Although theoretically different, the CFA currencies from each of the two regions are effectively interchangeable and have a fixed exchange rate to the euro. Despite being heterogeneous economies, these countries have been kept together by their common historical ties to the Francophone world. The existence of equivalent ties could also facilitate the creation of a union between the members of the EAC. Pegging the new EAC common currency to an international currency with a strong historical link such as the British pound could be an appropriate starting point.

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Figure 1: Real Exchange Rates of the member countries of the EAC

Figure 2: EAC Trend and Business Cycles from 1960 up to 2011 obtained with the Hodrick-Prescott filter

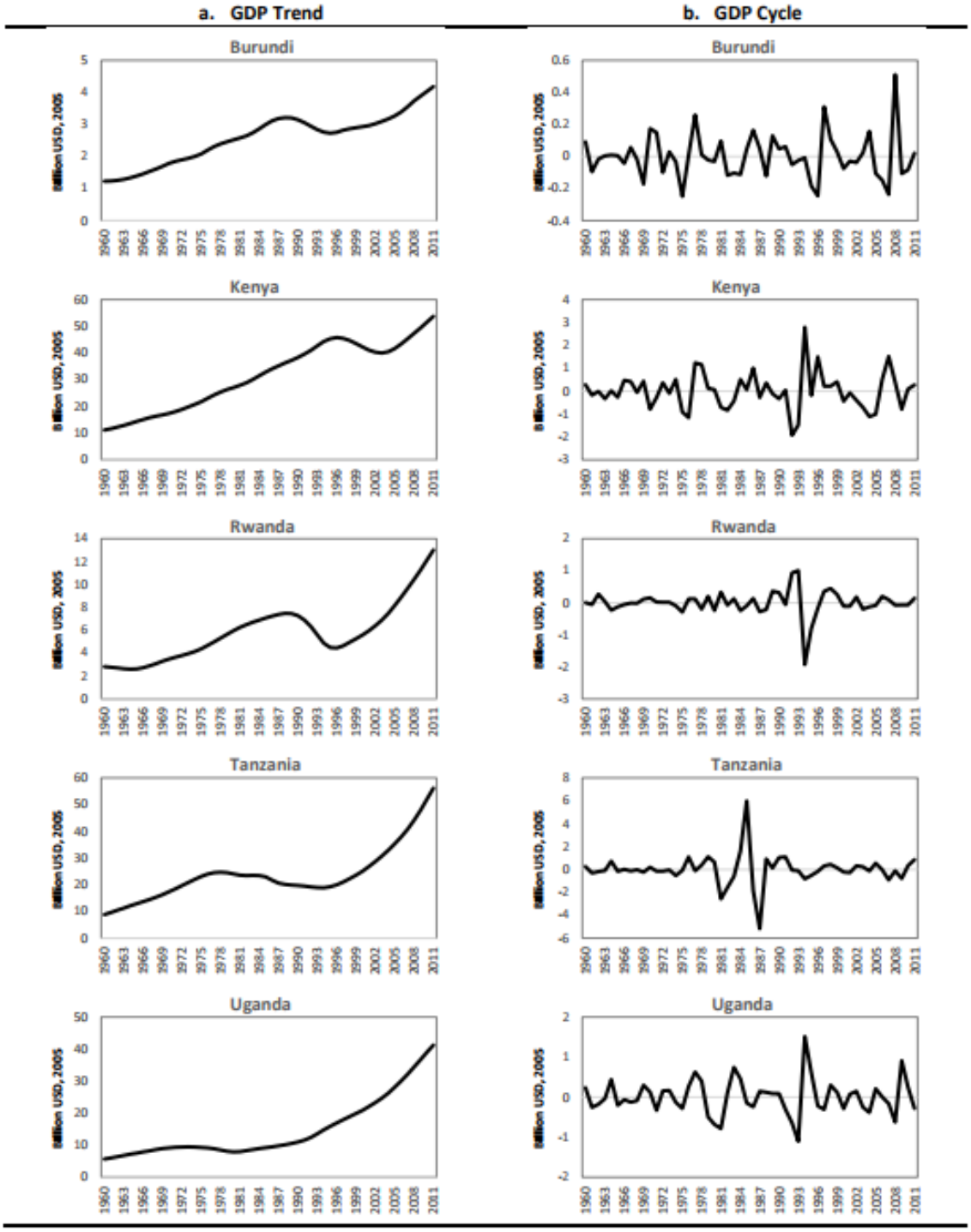

Table 1: Unit root test results (level)

Regions	Countries	ADF		KPSS		ERS	
		Intercept	Trend	Intercept	Trend	Interceptpt	Trend
EAC	Burundi	-12.02117***	-12.26035***	0.633800**	0.066219	0.460858***	1.319934***
	Kenya	-12.87034***	-12.97026***	0.285753	0.099174	0.213165***	0.796350***
	Rwanda	-16.41462***	-16.66984***	0.465540**	0.129004*	0.269527***	0.995164***
	Tanzania	-13.82535***	-14.02910***	0.488859**	0.065768	0.141447***	0.515228***
	Uganda	-19.73215***	-19.70431***	0.066046	0.037295	0.217988***	0.810317***

Table 2: Estimates of d using a parametric approach

	Countries	Differencing parameter
East African Community	Burundi	0.98 (0.88, 1.11)
	Kenya	0.94 (0.82, 1.07)
	Rwanda	1.01 (0.91, 1.15)
	Tanzania	0.74 (0.65, 1.06)
	Uganda	0.85 (0.75, 1.01)

Table 3: Bivariate cointegration relationships within the EAC

	Burundi	Kenya	Rwanda	Tanzania	Uganda
Kenya	0.127 0.938 0.987	---	---	---	---
Rwanda	**9.101** **9.647** **0.795**	2.714 0.169 0.918	---	---	---
Tanzania	**4.241** **2.463** **0.933**	**10.066** **1.844** **0.883**	**6.613** **3.971** **0.887**	---	---
Uganda	0.198 2.463 0.886	0.004 1.214 0.852	**0.348** **7.745** **0.793**	**12.930** **23.129** **0.523**	---

The first two values refer to the test statistics for H_x and H_y respectively using the Hausman test of Marinucci and Robinson (2001). The third value is the estimated value of d^*. $\chi_1^2(5\%) = 3.84$. In bold and with an asterisk, those cases where we reject the null hypothesis of no cointegration at the 5% level.

Table 4: Rank tests

Rank	D	LR statistic
0	0.463	80.74
1	**0.512**	**29.22**
2	0.639	7.57
3	0.653	2.36

Table 5: GDP Business Cycle Correlation 1960-2014

	Burundi	Kenya	Rwanda	Tanzania	Uganda
Burundi	1				
Kenya	0.8884	1			
Rwanda	0.9445	0.7543	1		
Tanzania	0.8760	0.7067	0.9033	1	
Uganda	0.8317	0.7548	0.7977	0.9040	1