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## Article

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# Cointegration test for the long-run economic relationships of East Africa community: evidence from a meta-analysis

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## Abstract

**Purpose** – The purpose of the paper is to test and analyze the equilibrium economic relationships of the East Africa Community (EAC).

**Design/methodology/approach** – To attain the study's purpose the authors applied the Johansen cointegration test, including long-run structural modeling (LRSM), vector-error-correlation-model (VECM) and variance-decomposition (VDC).

**Findings** – At I(1), both Phillips-Peron (PP) and Kwiatkowski-Phillips-Schmidt-Shin (KPSS) tests show that the East Africa member states' economies are cointegrated. The result was further substantiated by the tests based on Johansen cointegration and VECM procedures, showing significant long-run and short-run economic relations. The result further reveals that despite some uncommon issues among member states such as Tanzania and Kenya, however, their economic relationships remain significant though it is negative. Moreover, the finding revealed positive and significant short-run economic relationships between Kenya, Burundi and Rwanda.

**Originality/value** – The paper applies the cointegration techniques in the context of EAC. The result is likely to be adding value to the policymaker and also to the existing literature on the subject. This may trigger policy implications and open new research direction within the region and out.

**Keywords** Economic integration, East Africa community, Johansen cointegration test, Long-run economic relationships, LRSM, VECM

**Paper type** Research paper

## 1. Introduction

The cointegration technique has been developed recently over the past years; its rapid progress to a great extent is due to its usefulness in modeling the long-run relations of economic variables (economic equilibrium) from time-series data (Lütkepohl, 2004). The concept was initially developed by Granger (1981), and then Engle and Granger (1987) has become a standard tool in econometrics over the last four decades. The development of the concept was influenced by the fact that non-stationarity in time-series data, either stochastic or deterministic, can bring a major problem for econometric analysis as they produce a spurious regression.

## JEL Classification — E0, E1, F63

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This article would not have been well accomplished without the contribution and guidance of my professor, Dr Monzer Kahf to whom the author presented it as a term paper; then, Dr Kahf suggested sending it to the reputable peer reviewed journal for publication. Dr Monzer Kahf's contribution did not end there. Dr Kahf played another great role by proofreading the article throughout the revision processes.



To get rid of this problem, some researchers have suggested differencing the variables until the level of stationarity is reached (Utkulu, 1997). However, the differencing approach has its shortcoming because the data may lose some important long-run information. To bridge the gap, the concept of cointegration was introduced by Granger in 1981 as a breakthrough to the problem and thereafter Engle and Granger in 1987, which provided a theoretical base for testing and modeling the cointegrated non-stationarity time-series variables. Thus, the presence of cointegration between two or more economic variables suggests the existence of a genuine long-run economic relationship (equilibrium) that avoids the residuals getting bigger and bigger in the long run Engle and Granger (1987).

Therefore, the concept of cointegration is considered in the context of the EAC to determine whether the economies of the partner states are cointegrated or not. This follows from the economic postulation that “equilibrium is a stationary point characterized by forces which tend to push the economy back toward equilibrium whenever it moves away” (Engle and Granger, 1987, p. 225); this forms the foundation of the present study. Hence, the integrated countries will accrue economic benefits associated with the economic integration given that their economies are cointegrated, as cointegrated-economic variables tend to be in equilibrium in the long run.

In this case, the cointegration test provides a formal and useful basis for assessing the long-run and short-run models with the application of the actual economic data from the region, where we will explore this useful mechanism and effective formal structure for testing the existence and estimating long/short-run models from the real-time-economic variables. With the help of this concept, we will incorporate both economic theories, with the macro-economic variables’ long-run and short-run adjustment behavior, to understand the behavior of the economic relationships.

Therefore, in the present study, we apply the Johansen cointegration technique to test and analyze the equilibrium economic relationships in the EAC, utilizing the Gross Domestic Product (GDP) variables from each of the five-member states. The motivation behind is founded on several reasons:

Firstly, it is hypothesized that if an economic relationship exists between two or more variables, then these variables under consideration should be cointegrated (Granger, 1981; Engle and Granger, 1987; Badinger, 2001). Also, when two or more of these variables are cointegrated, then the short-term changes from equilibrium will feedback on the changes in the other variables to influence a movement toward the long-run equilibrium (Jones *et al.*, 2005). If the economies are cointegrated, it will spur effective economic growth to the integrated countries, as their economies tend to be in equilibrium in the long run. Otherwise, if two or more economic variables are not cointegrated, they will move in the opposite direction. Hence, economic integration, with such economic characteristics, becomes senseless.

Accordingly, based on such postulation, the economies of the partner states in EAC should be cointegrated, implying that they are likely to be in equilibrium in the long run. Therefore, we base our argument on this postulation to pre-suppose that if the economies in the region are not cointegrated, it will defeat the objective of realizing the intended economic benefits of the integration. In this case, the cointegration technique is used to determine the presence of such equilibrium relationships.

Second, there is an asynchronous and uneven economic gap among the EAC partner states. For instance, during the year 2019, Kenya had a GDP of \$US95,503, ranking as the first economy in the region, while the GDP for Burundi was only \$US3,012, ranking the least economy in the bloc. The presence of high-economic disparity among the member states further motivates the researchers to determine the presence of equilibrium relationships. This follows the assumption that I(1) time-series variables with a long-run harmonious relationship cannot drift too far apart from the equilibrium, since economic forces will act to restore the equilibrium relationship.

Additionally, the human development index 2018 depicts a disproportionate positioning of the five-member states in terms of development directory. While Tanzania, Uganda, Rwanda and Burundi have a lower human-development index, only Kenya has achieved a medium human-development index [1]. Moreover, two countries Kenya and Tanzania are categorized as middle-income economies, while the rest are classified as low-income economies.

Nevertheless, studies related to the cointegration test are limited in the context of the EAC region. The present study comes at a time when some other studies have focused on different issues like the entangled relationships among the member states in the East African region. These include turbulence in diplomatic relationships between Uganda and Rwanda (Byaruhanga, 2019) and trade and air space denial between Tanzania and Kenya by Himbara (2020). Others studies focused on currency optimality for the EAC bloc Mkenda (2001), EAC trade interdependency by Goto (2012) and the impact of external debt on economic growth Babu *et al.* (2014).

Moreover, there are several other studies related to the cointegration test including Garratt *et al.* (2006), Masih *et al.* (2009) and Hanclova (2011), which we benefitted from in building a framework for the present study. However, none of these studies have focused on the regional economic integration of the EAC. On the other hand, studies related to regional economic integration such as Badinger (2001), Baldwin (1993), Fritz (1997) and Balessa (1969) do not perform the cointegration test.

Therefore, the findings of the present study will be an addition to the existing body of literature and setting new research direction on economic integration. In addition, a crucial point in some previous studies undertaken for EAC and other regions is that they have employed different methodologies. Some have employed dummy variables for member states or by proxies of the market expansion Landau (1995), Henrekson *et al.* (1997), while others employed the univariate times series using the Generalized Method of Moments (GMM) approach Badinger (2001). The present paper utilizes the most recently developed cointegration techniques, including LRSM. Thus, we believe the findings might be essential for determining the policy priority and its implication on the member countries.

### 1.1 The objective of the study

Following the pressing need for economic cooperation with the anticipated goal of promoting sustainable growth, neighboring countries seek to strengthen their economies by entering some sort of Regional Trade Agreements (RTA) or the Regional Economic Integration Agreement (REIA) (Fritz, 1997).

The EAC member states also have been implementing various macro-economic reforms, which are intended to achieve convergence of the major macro-economic variables (EAC, 2013; EAC, 2007). The convergence or catch-up effects could be aided by several factors that may lead to a steady-state output, including integration of their economies (Hanclova, 2011), through the removal of unnatural cross-borders economic and non-economic barriers such as trade, movements of factors of production, etc. Hence, it is argued that in the East Africa region there is stronger trade interdependency than that of the Asian countries (Goto, 2012), with a stronger convergency of macro-economic variables including growth, exchange rates and inflation.

Based on Barro and Sala-i-Martin's (1992) economic growth theory these economies are in a transition state and converging to an integrated economy. Among the meanings of convergence, it is also equated with long-run co-movements (Mamingi, 2005).

Thus, the recent development in the econometric literature furnishes a means for determining whether a long-run relationship exists between variables that contain unit roots (Arize, 1994). Therefore, the present paper presents such a study using the Johansen cointegration technique with the application of yearly data from 1988 to 2019 to ascertain the

existence of a long-run economic relationship among the developing economies of EAC member countries.

Thus, the study will attain the following objectives. To the best of the researcher's knowledge, this paper will be among the few if not the first attempting to analyze the long-run economic relationships in the context of the East Africa economic integration. We suppose that the application of the newly developed time-series methods involving the seven steps including the VAR, VECM, VDC, LRSM, persistence profile (PP) and impulse response (IR) will be the earliest in this region. In this way, the study will set a new research direction in the context of EAC economic integration and other regions.

The remaining part of the paper is arranged as follows: sub-section two elaborates the overview of the EAC; section two introduces the related empirical studies; section three analyzes the methodology; the rest sections present the findings and the conclusion with the suggestion for future studies.

### 1.2 The East Africa Community (EAC) at a glance

Economic integration is mainly considered a post-war movement that gained popularity after 1953 due to devastation brought by Second World War that forced politicians to consider the means that could reduce the likelihood of occurrence of conflicts and war among the nations (Fritz, 1997).

However, nowadays, most economic integrations focus on broader objectives ranging from security reasons to economic reasons. In line with that, the first EAC was instituted by three partner states in 1967, namely Kenya, Tanzania and Uganda but then collapsed only a decade later in 1977 (Hazlewood, 1979). According to Hazlewood (1979), the former EAC was the only proposal for economic integration scheme that covered a wide range of activities in a highly organized system. Later on, the new EAC was revived on the last day of November 1999 and came into operation in July 2000 [2] and now comprising six partner states: Tanzania, Kenya, Uganda, Rwanda, Burundi and recently South Sudan.

But, according to Maxon (2009), there have been historical interactions between various ethnic groups of the East Africa region even before the 1890s that were observed through physical movement and societal development. And there had been closer integration of economies of the three partner states, namely, Kenya, Tanzania and Uganda even before these countries gained their independence (Hazlewood, 1979), where, in 1923, a customs union had been established between the three partner states (Ravenhill, 1979). In addition, the three partner states inherited this arrangement even after their independence with a common currency and services in the field of communications, including, railways, postal, harbors and telecommunications.

The newly EAC bloc works under the Treaty of 1999, which established four main pillars for cooperation, namely, *customs union*, *common market*, *monetary union* and *political federation*; these pillars form the cornerstones of the EAC regional economic integration. Several factors have inspired the revival of the new EAC, namely, globalization, stronger political will, the need to strengthen small economies by expanding markets to avoid marginalization and the desire to achieve sustainable economic development (Ng *et al.*, 2003).

It is argued that economic integration can influence the rate of output growth that is realized through a faster growth of total factor productivity, particularly return on investment in human and physical capital (Baldwin and Venables, 1995; Romer, 1994). This is so because integration influences investment inflows into the region from non-member countries. These flows lead to an increase in GDP and consequently in Growth National Product (GNP) in member states (Karakaya and Cooke, 2002).

Hence, economic integration leads to either short-run or long-run growth effects; however, to reap effective growth effects, the economies of the member states need to be cointegrated

Badiger (2001). Nevertheless, there is a dearth of literature related to cointegration techniques in the East Africa region; therefore, the present study is attempting to fill this research gap.

## 2. Literature review

This section revised several studies related to the subject matter to build the foundation of the present study and identify the areas for contribution. There are several empirical studies conducted to analyze the impacts of Regional Economic Integration (REI) or Regional Integration Agreement (RIA) on growth. Some have gone further to analyze the long-run economic relationships among various macro-economic variables.

### 2.1 Relationships between regional economic integration and growth

Economic integration is defined as a “process and as a state of affairs” (Balessa, 1969, p. 1). The phrase is defined as a process, as using in this context entails the actions adopted to reduce any discrimination between the economic entities belonging to individual countries. Where as a state of affairs implies the pragmatic action undertaken to reduce any form of discrimination as agreed by the integrating countries.

Thus economic integration is distinguished from economic cooperation in the sense that economic cooperation involves the actions targeted at reducing discrimination, whereas economic integration incorporates the measures that suppress and abolish any sort of discrimination between the integrated countries (Balessa, 1969). Hence, economic integration influences growth if the return on investment is positive; this includes human, capital and knowledge that spur on the accumulation (Baldwin, 1995), as integration facilitates an increase in investment ratio and labor movements.

Hence, it is argued that the overall effects of regional economic integration can be observed at the level of income such that RIA leads to improved public well-being of the integrated countries (Meade, 1953). It (REI) facilitates economic growth through trade, the flow of investment, improved efficiency due to competition and specialization because it accelerates free trade and free capital flow across borders among member countries through trade liberalization that is customarily designated in the context of the General Agreement on Tariffs and Trade (GATT) (Badinger, 2001).

Thus, it is postulated that economic integration may lead to either permanent or temporary growth effects (Badinger, 2001). The permanent growth effect is realized when there is constant economic growth where the slope of the growth curves remains steeper in the long run. On the other hand, a temporary growth effect is achieved when there is an upward movement of the growth curve only in the short run.

These two extreme scenarios are further linked to economic integration with *endogenous* and *neoclassical growth* theories. Based on neoclassical growth theory, economic integration has no impact on a long-run growth rate, because in neoclassical theory growth is determined by exogenous factors such as technological advancement, such that the changes in institutions like economic integration have only a temporal growth impact (Baldwin, 1993). But as for endogenous growth theory, economic integration leads to a permanent-growth effect (Baldwin, 1993). In another study, Baldwin and Seghezza (1996) introduced the two terms, namely, “*integration-induced technology-led growth*” and “*integration-induced investment-led growth*,” such that economic integration may lead to an increase in the demand for capital due to lower costs of capital through the use of cross-borders intermediate goods, trade liberalization and the lower credit costs as a result of the integration of regional financial markets.

However, the empirical findings have yielded mixing results. Some empirical findings support the idea that regional economic integration leads to long-run economic impacts, while others support the idea that regional integration leads only to short-run economic impacts;

these are evident from the study in Portugal and Spain, which substantiated the role of RIA in the economies of the two countries. The two countries spurred with investment booms once the accession to the European Community appeared to be certain (Baldwin *et al.*, 1995).

Another aspect is observed from Mexico when the North America Free Trade Area (NAFTA) was initially expected to bring novel hope for attracting foreign investment in the country, and certainly, a flood in such investment occurred when the agreement became clear (Baldwin *et al.*, 1995).

Coe and Moghadam (1993) applied the time-series data for France to conduct the cointegration test between the non-farm GDP, physical capital, labor and cumulated expenditure on Research and Development (R&D). In their study, they defined an integration proxy as the ratio of intra-European Community trade to Global Depository Receipt (GDR); their study concluded that the European Community Integration is attributed for the French annual growth rate of 0.3%.

Italianer (1994) estimated using a linear regression model between the rate of income growth and the proxies of intra-trade from the European Community's member states. The findings concluded that the RIA proxy is positively and statistically contributed to economic growth. The study by Norman and Motta (1993) also analyzed the Japanese economy with the European Union (EU) markets, observed an influx of outsider firms' investment into the integrated bloc with improved market accessibility, while the expanded country size may result in scattering of Foreign Direct Investment (FDI).

Hence, it is concluded that regionalism facilitates intra-manufacturing FDI in the integrated countries, which leads to further economic growth. Further empirical evidence by Baier *et al.* (2018) uncovered both intensive and extensive margins of trade to be affected by economic integration. The study applied a panel data set from 1962 to 2000 and found more significant impacts on the aggregate flow of trade in the member states.

The study by Baier and Bergstrand (2007) reveals on average, in 10 years, a free trade area (FTA) can double, at least, two members' bilateral trade. However, the effects of the FTA depend on the particular characteristics of member states, such as trade profiles, pre-existing tariff arrangements and geographical closeness.

Contrary to the above findings, Badinger (2001) tested the economic growth effects on EU economic integration using the data from 1950–2000; the paper found no permanent, while other studies have shown that the stock of FDI in the Central and Eastern European Countries (CEEC) deviates from the normally expected patterns and found no evident impact of FDI on these countries as a result of European Commission (EC) integration. Also, DiMauro *et al.* (2001) found no proof that the increased flow of investment in Portugal and Spain during the 1980s significantly lowered investment flows to the rest of the European member states.

De Melo *et al.* (1992) find no growth effects of the RIAs. In their study, they employed the Ordinary Least Squares (OLS) method on cross-country data to evaluate the income growth rates, along with dummies for the European Free Trade Area (EFTA).

On the other hand, it is argued that the economic effects of economic integration in developing countries may vary from one region to another. This is because most developing countries experience different levels of economic structures and infrastructural levels (Baier *et al.*, 2018). Hence, the impact of integration on the economy depends on the infrastructure of the respective countries in that region; for instance, it is observed that underdeveloped countries encounter higher-fixed costs on trade, which are partly attributed to higher costs of border-crossing due to weaker infrastructures (Baier *et al.*, 2018).

In the context of the EAC, it is observed that the most active participants in the cross-border trade are the local small-scale traders who cluster in border regions seeking to sell their products in nearby markets by crossing the borders (World Bank, 2012) to the extent that the impact of exports on growth has been fairly limited (McAuliffe *et al.*, 2012).

Further studies reveal that the growth effect is temporary and highly localized where the cities closer to the community's internal borders approximately 90 min of travel from the borders have grown more rapidly than the cities located further inland (Eberhard-Ruiz and Moradi, 2019). This is because EAC's borders facilitate social and economic activity interactions; hence, people living closer to the borders are the ones who first benefit from FTAs, tariffs and, perhaps, from the diminished quantitative barriers.

Nevertheless, it is generalized that economic integration brings either permanent or temporary economic growth effects. Succinctly, economic integration accelerates either short-run or long-run growth effects (Baldwin, 1993). But Badinger (2001) argues for economic integration to spur effective long-run growth effect the economies must be cointegrated.

Therefore, the present paper applies the concept Johansen cointegration test in the context of the EAC to analyze empirically the theoretical economic relationships through the application of various econometric tools including the LRSM developed by Garratt *et al.* (2006).

This is so because, to the best of our knowledge, we did not find recent studies related to the cointegration test of regional economic integration using the same methodology most of the available studies in EAC are related to; for instance, Babu *et al.* (2014) investigated the impact of external debt on EAC economic growth using a panel-data approach with the Hausman test; the findings reveal a negative growth effect for external debt on GDP. Another study by Goto (2012) finds that the extent of trade interdependency in the EAC region is stronger than that of the Asian countries; the study further reveals a stronger convergent in the macro-economic variables such as growth, exchange rate and inflation. Whereas Mkenda (2001), through the generalized purchasing power parity application, explored the currency optimality for the EAC economic integration; the finding reveals the optimal real exchange rate in East Africa between 1990 and 1998.

Other studies employed different methodologies for instance De Melo *et al.* (1992) employed OLS to evaluate the growth effects for the EU. But according to Badinger (2001), OLS is not an appropriate method of estimation to determine the growth effect because several regressors are endogenous, and therefore, the correlation between the omitted and included variables may be subject to biases. Also, the practical regressions are inefficient in capturing the effects of investment creation, as these regressions cannot determine the causality effect. Moreover, the application of panel data is deemed inefficient for developing countries (Dinda, 2004; Friedl and Getzner, 2003; Masih *et al.*, 2009), as they experience different stages of economic development. On top of that, most of these studies did not perform the cointegration test. Therefore, the present paper serves as a contribution to the existing body of literature on the subject matter.

### 3. Methodology and data sources

This paper utilizes a sample time-series data set consisting of non-overlapping samples of annual GDP for 32 years from 1988 to 2019, which is measured in the current US\$ extracted from the World Bank. We extracted other data sets such as inter-trade data from the UN international Trade Statistics Database (COMTRADE) database and other published secondary sources. Please note here that the application of the intra-trade data was undertaken just to validate how the findings of the study can be related to some economic variables such as trade; the reason behind choosing the intra-trade data is because the previous study by Goto (2012) reveals a stronger trade interdependency in the East Africa region. Moreover, to attain the research objective, we apply the Johansen cointegration technique with the help of the Microfit Software package.

The time-series approach is regarded as appropriate for testing cointegration in developing countries, as they experience different stages of development with diverse institutional setups (Dinda, 2004; Friedl and Getzner, 2003; Masih *et al.*, 2009). This is because the time-series

approach captures the dynamics of the variables in question as opposed to a cross-sectional approach that assumes the parameters are constant across countries/units (Masih *et al.*, 2009). The researchers pre-suppose that as long as the overall economic effects and benefits related to the economic integration whether it may be from trade, capital and labor and technology flow. The overall impact might be accrued to the GDP, [see also World Bank (2012)].

Therefore, the GDP proxy is preferable in measuring the level of the economy, which up to date is the most accepted measure of the economy. In addition to that, our analysis employs the most recent time series technique to cointegration tests, such as vector auto-regression (VAR), LRSM, VECM, VDC, IR and persistence profile (PP).

In the first place, the paper conducts a unit-root test; a unit-root test is used to determine the stationarity of the variables (Priestley and Rao, 1969). The data must be stationary to produce a reliable result. Next, we determine the order of the VAR, as it is believed that the variables that are in the VAR are expected to be cointegrated (Sims, 1980). Then, it applies the Johansen cointegration. Next, the recent approach to econometric tests was deployed, applying the seven steps toward the cointegration test.

Furthermore, to arrive at meaningful and conclusive results, we needed some combinations of the techniques; this is because ECM and VDC have their limitations in that they estimate the cointegrating vectors based on the mere theoretical assumption (Masih *et al.*, 2009). This limitation was solved by the application of LRSM (Pesaran and Shin, 2002; Masih *et al.*, 2010). The LRSM quantifies the results of the estimates based on the theoretical cointegration by imposing exact and over-identifying restrictions (Masih *et al.*, 2010).

So long as the existence of cointegration, LRSM does not say anything about which variable is a leader variable and which variable is a follower. Therefore, this issue was taken care of by the application of VECM; the VECM is the re-arrangement of the VAR model developed by Sims (Hanclova, 2011), which, in turn, is helpful to indicate the Granger causality for the long run and short run (Masih *et al.*, 2009).

Nevertheless, the application of VECM cannot indicate the extent of exogenous and endogeneity of the variables; hence, the study employs the VDC technique. VDC is helpful in this sense as it indicates which variable is strong exogenous or endogenous (Masih *et al.*, 2010). An exogenous variable also can act as a pressing variable (Schneider *et al.*, 2008). It is a variable that is not influenced by other variables in the underlying model, while the endogenous variable can be affected by another. Hence, the variable, which is explained primarily by its past shocks, is considered the most exogenous compared to others.

Furthermore, the study applied the IR; IR is useful to analyze the responses to the shock of one variable and its effects on other variables (Pesaran and Shin, 2002). That is to say, it shows how other variables will respond to economic shocks that originated from one individual variable. And finally, the PP was used. PP helps to understand the speed with which the variable can get back to its original equilibrium when the entire cointegrating equation is shocked (Masih *et al.*, 2009).

### 3.1 Definition of variables

We have utilized the GDP variables measured in current US\$ for all five member countries to perform the cointegration test. They are represented as follows: KY as the GDP for Kenya, TY as the GDP for Tanzania, RY as the GDP for Rwanda, BY as the GDP for Burundi and UY as the GDP for Uganda.

The Johansen technique applies the maximum likelihood procedure to examine the existence of cointegrating vectors in non-stationary time series in a dimensional or re-arrangement for VAR (Baharumshah *et al.*, 2008). This can be represented in an equation with the variables matrix as shown in equation (1). Consider the VAR of order  $k$  in equation (1).

The I(1) time series  $X_{t-1}$  and  $X_{t-k}$  are said to be cointegrated if a linear relationship exists of the form as in equation (1), where  $X_t$  is I(0).

$$X_t = \delta + \Gamma_1 X_{t-1} + \Gamma_2 X_{t-2} + \dots + \Gamma_k X_{t-k} + \prod X_t + \varepsilon \tag{1}$$

This VAR can be re-written as follows:

$$\Delta X_t = \delta + \sum_{i=1}^{k-1} \Gamma_i \Delta X_{t-i} + \prod X_{t-k} + \varepsilon_t$$

where,

$$\prod = \sum_{i=1}^k (\Gamma - 1)$$

and

$$\prod_i = \sum_{i=1}^k (\Gamma)$$

Such that  $X_t$  is the non-stationary I(0) times-series vector for the proxies of GDP of the five-member countries,  $t$  is a linear trend.  $i = 1, 2, \dots, k$ , are the autoregressive approximations of moving average.  $\Delta$  is the operator for the first difference, i.e.  $\Delta X_t = X_{t,i} - X_{t-k}$ .  $\delta$  is a constant term,  $\Gamma$  represents coefficients,  $\varepsilon$  represents an uncorrelated random error term and  $\prod$  is the matrix for the long-run impact matrices.

#### 4. Estimation and analysis of empirical findings

This section presents the results from the econometric analysis and provides an appropriate interpretation based on the findings. It starts with descriptive statistics and then presents the findings' results.

##### 4.1 Descriptive statistics

Table 1 shows the output results of the mean, maximum, minimum and standard deviation generated from individual country's economy in the EAC from 1988 to 2019.

The mean describes the average share of individual GDP hereinafter the economy for 32 years in the EAC. When the output from Table 1 is taken into consideration, it implies that between 1988 and 2019 the average shares of the economy for Kenya (KY), Tanzania (TY), Uganda (UG), Rwanda (RY) and Burundi (BY) in the EAC are 30,603, 23,095, 14,508, 4,233 and 1,576, respectively; Kenya has the highest share of the economy followed by Tanzania, while Burundi has the lowest share among all five countries in the region. The output also indicates that there is a high-economic discrepancy in the region, as shown by the standard deviation. For instance, for the period between 1988 and 2019 the standard deviation for Kenya's GDP is 26,375, while that of Rwanda and Burundi are only 3,042 and 00,830, respectively.

##### Descriptive statistics

	Maximum	Minimum	Mean	Standard deviation
KY	95,503.00	5,751.00	30,603.00	26,375.00
TY	63,177.00	4,257.00	23,095.00	18,565.00
BY	3,172.00	784.00	1,576.00	830.00
RY	10,122.00	753.00	4,233.00	3,042.00
UY	34,387.00	2,857.00	14,508.00	11,495.00

**Table 1.**  
Descriptive statistics,  
mean, maximum and  
standard deviation

Table 2; shows the correlation matrix for the territorial economies; these correlations are very strong. This further indicates that the economies of the EAC member states to some extent are much correlated to each other.

#### 4.2 Stationarity test

To determine the order of cointegration, first we have performed unit-root testing. The test employed the semi-parametric Phillips–Peron test suggested by Phillips and Perron (1988) and Phillips (1991) and Kwiatkowski *et al.* (1992) results in Table 3.

This step is necessary because the availability of unit root in the time-series data produces spurious relation; spurious relation assumes certain relationships but with a unit root such a relationship does not exist. In level forms I(0), all variables were discovered to be non-stationary. However, in the first difference I(1), they were found to be stationary.

Table 3 shows the output results for the stationarity test; the asterisks indicate that the output is significant at 5%. The results contain both with and without a linear trend. The Philip–Peron (PP) test rejects the null hypothesis (H0) of the unit root, while KPSS accepts the hypothesis that the variables are stationary at I(1). Based on the output in Table 3, it is invaluable to determine that the variables are cointegrated at I(1). Having found that the data are stationary, it is worth moving forward to the next step.

#### 4.3 Selection of order for the vector-autoregression (VAR)

The subsequent stage of the modeling arrangement is to examine the order of the unrestricted VAR for the macro-economic variables. Based on the Akaike Information Criterion (AIC), the optimal lag order was chosen at VAR (3), which is reasonable for this study. This is because if the lag is very short, the model may be inadequately specified while extremely long as well as numerous degrees of freedom might be lost (Hanclova, 2011). Hence, the number of lags should be sufficient for the residual from the estimation to represent individual white noise. The output is not shown here. However, it is available to the researchers.

	KY	TY	BY	RY	UY	
KY	1					
TY	0.985545	1				
BY	0.961005	0.949784	1			
RY	0.972628	0.971827	0.984568	1		
UY	0.948381	0.966152	0.961898	0.978096	1	

**Table 2.**  
Correlation matrix

Stationarity tests KPSS I(1)	Variables	No trend	Trend	
Stationarity test Phillips–Peron I(1)	DKY	0.29833*	0.17258	
	DTY	0.23553*	0.19331*	
	DBY	0.22440*	0.13881*	
	DRY	0.24420*	0.15337*	
	DUY	0.26719*	0.19179*	
	DKY	3.9491*	4.2317*	
	DTY	5.1549*	4.9558*	
	DBY	4.4550*	44.681*	
	DRY	6.1870*	6.6249*	
	DUY	3.3404*	3.1167	

**Note(s):** the notation \* represent 0.05 significant level

**Table 3.**  
Stationarity test at I(1) by KPSS and Phillip–Peron statistical tests

4.4 Test for cointegration and the long-run relations

After determining the applicable lag order for VAR, in the next step, we ran the Johansen cointegration tests using the maximal eigenvalue and trace test stochastic matrices and the LRSM. This procedure offers robust outcomes, especially when the variables exceed more than two (Gonzalo, 1994). To accomplish this procedure, we employed a Microfit software program.

Based on the unit-root test result, the study assumes both with and without a trend in the cointegrating relations. The cointegration outputs are shown in Table 4; again, the asterisks show a significance level at 5%, where both maximal eigenvalue and trace tests indicate that, at least, three cointegrations exist by rejecting the H0 which stated that there is no cointegration ( $r = 0$ ) but cannot reject  $r = 1$ ,  $r = 2$  and  $r = 3$ . Therefore, there are three significant cointegrating relationships among the variables of five economies in the EAC bloc.

Notice here that the availability of cointegration among EAC economies implies that to some extent the economies of the EAC countries are interdependent on one another and are highly integrated (Masih et al., 2010) as if they are components of one integrated region. Thus, the coefficients of the cointegrating equation encompass useful information of whether the previous values influence the present values of the variables in the long run. Non-cointegration, in principle, would imply that the influence to bring these economies together in the long term is zero (Schwarz and Szakmary, 1994), while cointegration entails that each economy (variable) contains a sort of information (variable) on the projection of the others (Masih et al., 2010).

Hence, the presence of cointegration is sufficient evidence to suggest that the EAC economies are in equilibria in the long run (Masih et al., 2010). That is to say, there is a certain economic relationship that exists among the economies of the EAC member states. Therefore, it is worth saying that the economies of the EAC member countries are cointegrated. This further indicates that certain common influences bring these economies closer in the long run.

Having noticed three cointegrating vectors enables us to proceed in performing the LRSM to identify whether the coefficients of the cointegrating vectors are coherent with the priory information of the economy. Thus, the study can now proceed to impose restrictions to uncover these restrictions for every single relation.

Long-run test	H <sub>0</sub>	H <sub>1</sub>	T-statistics	5% critical value	10% critical value
Maximal eigenvalue	$r = 0$	$r = 1$	79.4313*	37.8600	35.0400
	$r \leq 1$	$r = 2$	43.2443*	31.7900	29.1300
	$r \leq 2$	$r = 3$	27.5426*	25.4200	23.1000
	$r \leq 3$	$r = 4$	15.8700	19.2200	17.1800
Trace test	$r = 0$	$r \geq 1$	175.0451*	87.1700	82.8800
	$r \leq 1$	$r \geq 2$	95.6137*	63.0000	59.1600
	$r \leq 2$	$r \geq 3$	52.3695*	42.3400	39.3400
	$r \leq 3$	$r \geq 4$	24.8269	25.7700	23.0800

**Table 4.** Cointegration LR test based on maximal eigenvalue and trace of the stochastic matrix for East African countries GDP's 1988–2019

Rank	Maximized LL	AIC	SBC	HQC
$r = 0$	151.7431	96.7431	59.1424	84.9670
$r = 1$	191.4587	126.4587	82.0216	112.5416
$r = 2$	213.0809	140.0809	90.1746	124.4508
$r = 3$	226.8521	147.8521	93.8439	130.9374
$r = 4$	234.7871	151.7871	95.0444	134.0160

**Note(s):** notation \* represent 0.05 significant level

This allows estimating the LRSM in the next sequence, by first imposing exact-identifying restrictions and then performing over-identifying restrictions for the cointegrating vectors. With three cointegrating vectors, further, the LRSM analysis starts with exactly identifying restrictions as follows:

$$\begin{aligned} \beta_{13} &= 1, \beta_{14} = 0, \beta_{15} = 0 \\ \beta_{23} &= 0, \beta_{24} = 1, \beta_{25} = 0 \\ \beta_{33} &= 0, \beta_{34} = 0, \beta_{35} = 1 \end{aligned}$$

The three (3) cointegrating vectors above can further be denoted as follows:

$$\begin{aligned} \beta_{21} &= (\beta_{21}, \beta_{22}, \beta_{23}, \beta_{24}, \beta_{25}, \beta_{26}) \\ \beta_{32} &= (\beta_{31}, \beta_{32}, \beta_{33}, \beta_{34}, \beta_{35}, \beta_{36}) \\ \beta_{43} &= (\beta_{41}, \beta_{42}, \beta_{43}, \beta_{44}, \beta_{45}, \beta_{46}) \end{aligned}$$

Note that every vector above has six elements of which the first five ( $\beta_{21}, \dots, \beta_{26}$  and 5) represent the coefficients of the variables at I(1), i.e. LKY, LTY, LRY, LBY and LUY, respectively, while the last one;  $\beta \dots 6$  describes the time trend.

So long as the exact identifying restrictions above do not enforce any verifiable restrictions on the cointegrating VAR model, this can be further rearranged as follows:

$$\prod_{\text{Exact}} = \begin{pmatrix} \beta_{21} & 0 & 1 & 0 & \beta_{25} & \beta_{26} \\ \beta_{31} & 0 & \beta_{32} & 1 & \beta_{33} & 0 \\ \beta_{41} & 0 & 1 & \beta_{44} & 0 & \beta_{46} \end{pmatrix}$$

The output results for exact-identifying and over-identifying restrictions are further the model shown in Table 5.

As shown in Table 5, the outputs depict the maximal likelihood and trace test estimations subjected to exactly-identifying restriction (left side) and over-identifying restriction (right side) with the standard errors in parentheses. The LRSM estimates on the right-hand side of

Exact identifying	Vector 1	Vector 2	Vector 3	Over identifying	Vector 1	Vector 2	Vector 3
LKY	1 (NONE)	0 (NONE)	0 (NONE)		1 (NONE)	0 (NONE)	0 (NONE)
LTY	0 (NONE)	1 (NONE)	0 (NONE)		0 (NONE)	1 (NONE)	0 (NONE)
LBY	0 (NONE)	0 (NONE)	1 (NONE)		0 (NONE)	0 (NONE)	1 (NONE)
LRY	-0.69386* (0.21267)*	0.63753* (0.21858)*	-1.0432* (0.24938)*		0 (NONE)	0 (NONE)	0 (NONE)
LUY	0.49423 (0.29394)	-0.34175 (0.30246)	0.027881 (0.34376)		0 (NONE)	0 (NONE)	0 (NONE)
Trend	-0.087068* (0.01495)*	-0.11766* (0.0155)*	0.025817 (0.01724)		0 (NONE)	0 (NONE)	0 (NONE)
Log-likelihood		226.8521				168.9741	
Chi sq-X <sup>2</sup> Q(3)		NONE				115.7561 [0.000]*	

**Note(s):** notation \* represent 0.05 significant level

**Table 5.** Structural long-run-model for the EAC economies subject to exact and over-identifying restrictions (standard error – SE in parentheses)

Table 5 show that the coefficients of LRY are significant at 5% except for that of LUY. This implies that the coefficients of LUY are insignificant; however, when we tested the coefficients of LRY and LUY altogether by imposing the over-identifying-restriction of “zero/insignificant” for all variables together, we did not find sufficient evidence to support this.

Note from Table 5 that LKY, LTY, LBY, LRY and LUY are proxies for the GDP variables for Kenya, Tanzania, Burundi, Rwanda and Uganda, respectively, in the level forms, while vectors 1, 2 and 3 stand for LKY, LTY and LBY respectively. Notice that this is where we imposed the exact-identifying restrictions by standardizing LKY, LTY and LBY on the left side; the coefficients of LRY has a significant long-run impact on all of the three vectors, which can be further taken that the economy of Rwanda has a significant long-run relationship with the economies of Kenya, Tanzania and Burundi, while LUY does not.

Additionally, on the right-hand side of Table 5 are the outputs for over-identifying restrictions as explained above; notice the  $\chi^2$  and the  $p$ -value is 115.7561 and [0.000], respectively; this rejects the over-identifying restrictions assumption that all coefficients are equal to zero. Thus, we will proceed by taking the over-identifying output's result.

By taking into consideration the over-identifying result, it further denotes that the economies of the EAC partner states are cointegrated in the long run. This cointegrating relationship is also co-trending which was expected (relationships include a linear trend). Hence, integrating countries are expected to affect productivity and steady-state yields.

#### *4.5 Estimating and analyzing the VECM and VDC among the economies of the East Africa Community (EAC) member countries*

To analyze the concept of Granger causality with respect to the EAC's economies in the study, we have performed the VECM and VDC tests. The VECM model, as shown in Table 6, helps understand the influencing variable (GDP in this case). It helps to determine which variable (GDP) is the leader or follower, which simply means to distinguish which economy is the most exogenous or endogenous. Notice again from Table 6 that the magnitude of the coefficients of the error-correction term indicates the extent of adjustment of the respective dependent variable, while the value in parentheses indicates their significant levels.

Hence, the error correlation models as shown in Table 6 show that the proxies associated with economies of Tanzania (TY), Burundi (BY), Rwanda (RY) and Uganda (UY) are exogenous, while that of Kenya (KY) is endogenous. This implies that it is possible to predict the Kenyan economy using economic variables of other member states in the region, which further implies that the Kenyan economy is partly influenced by the changes in the economic levels of the other countries in the region. In a simplistic terminology, it means the GDP variable of Kenya can respond faster to the economic changes of other member states in the long run. In another language, Kenya is partly more dependent on other countries in the region than others can depend on Kenya. However, to validate this, we will relate this finding with the intra-trade data of the EAC region.

Observe again the output in Table 6; the VECM concept also helps to distinguish between the short-run and long-run equilibria. The short-term relationship is shown by the error correlation model with the lagged variables with 1 and 2, while the  $F$ -tests in parentheses show their joint significant or insignificant levels. If these (lagged coefficients) are significant, as shown by asterisks, it is sufficient to imply that past equilibrium can influence the current outcomes in the short run, or simply to say that there exists a significant short-run statistical equilibrium.

Hence, the influence of each variable in the short run at 5% reveals a significant positive influence of the first leg of KY1 on the current variable of RY and the first of BY1 on RY, while the second lag of TY2 has a negative but significant effect on current KY in the short run. This further implies that in the short run. There is a significant negative-economic

Regressor	KY	TY	BY	RY	UY
Intercept	-3.512 [0.126]	2.017 [0.316]	-0.585 [0.738]	3.975 [0.113]	0.635 [0.869]
dKY1	0.696 [0.079]	0.024 [0.944]	0.295 [0.329]	1.099 [0.015]*	0.176 [0.788]
dLY1	-0.223 [0.463]	0.108 [0.690]	0.017 [0.944]	0.813 [0.023]*	0.021 [0.969]
dTY1	-0.314 [0.191]	-0.109 [0.601]	-0.301 [0.118]	-0.026 [0.920]	-0.143 [0.726]
dRY1	-0.104 [0.600]	0.027 [0.879]	-0.025 [0.874]	-0.828 [0.001]*	0.054 [0.876]
dUY1	0.307 [0.053]**	0.097 [0.470]	0.143 [0.235]	-0.192 [0.245]	0.342 [0.200]
dKY2	0.834 [0.045]*	0.219 [0.532]	0.167 [0.587]	0.475 [0.270]	-0.032 [0.962]
dLY2	-0.417 [0.225]	-0.481 [0.124]	-0.205 [0.445]	0.456 [0.223]	-0.388 [0.511]
dTY2	-0.477 [0.035]*	-0.187 [0.327]	-0.117 [0.484]	0.277 [0.235]	0.043 [0.907]
dRY2	0.096 [0.527]	0.033 [0.806]	0.247 [0.052]**	-0.320 [0.064]	0.080 [0.759]
dUY2	0.206 [0.203]	0.083 [0.559]	0.089 [0.479]	0.070 [0.684]	0.101 [0.716]
ecm1(-1)	-0.999 [0.040]**	0.442 [0.284]	-0.253 [0.483]	0.407 [0.412]	0.039 [0.961]
ecm2(-1)	0.588 [0.084]**	-0.264 [0.368]	0.087 [0.735]	-0.524 [0.150]	0.083 [0.882]
ecm3(-1)	0.634 [0.027]*	-0.292 [0.227]	0.203 [0.337]	-0.115 [0.688]	0.011 [0.981]
SC	0.075 [0.788]*	0.245 [0.628]*	0.512 [0.486]*	0.100 [0.992]*	0.204 [0.989]*
FF	2.451 [0.140]*	7.5843 [0.016]*	1.038 [0.326]*	9.736 [0.008]*	0.857 [0.977]*

Note(s): notations \* and \*\*, 5% significant level and 10% significant level, respectively

**Table 6.**  
Error correlation model  
estimates for the  
variables of EAC  
economies 1988–2019

relationship between Kenya and Tanzania and positive economic relationships between Kenya, Burundi and Rwanda.

At 10%, the first leg of UY has a significant positive influence on KY and the second leg of RY2 positively influences the current variable of BY; this influence is also significant. Further, it reveals an insignificant relationship between Rwanda (RY) and Uganda (UY) in the short run. Apart from other things (*ceteris paribus*), we suppose this can be partly attributed due to the turbulent relationship between these two countries (*i.e.* Rwanda and Uganda). For instance, the borders between the two countries as of recent remain closed (Himbara, 2020). This could be the results of short-term political or economic policies of the particular country, which may impact the short-run economic relations because the closure of the borders results in the closure of all other social and economic activities between the countries; hence, their economies cannot be influenced to each other in the short run. On the other hand, following the diplomatic turbulences that led to the recent airspace denial and blockade between Tanzania and Kenya, the findings reveal a significant negative economic relationship in the short run. This implies that the economies of the two countries (Kenya and Tanzania) negatively influenced each other in the short run. This finding is consistent with the EAC bloc's intra-trade volume, which is elaborated from Tables 8 and 9.

Likewise, we have tested the diagnostic models of all equations and found that they are free from residual serial correlation shown by Serial Correlation (SC). This further implies that the chosen lag order at I(1) is elevated enough to deal with the residual serial correlation problem.

Given the fact that the VECM technique above cannot tell the extent of exogeneity and endogeneity of the variables (Johansen, 1995), therefore, to get an understanding of the exogeneity and endogeneity, we have conducted the VDC as shown in Table 7. Through the application of this technique, we will be able to understand which variables are strong (leaders) and weak (followers).

As shown in Table 7, the proxy associated with the Ugandan economy (UY) is highly exogenous across the out-of-sample projection intervals, where it is postulated that the proportional degree of exogeneity and endogeneity of a variable can be determined by its own past shocks. Thus, the variable which is described mostly by its past shocks (UY in this case) is believed to be the highest exogenous than the others. At the end of the year nine- and year three-time horizons, the GDP proxy of Uganda (UY) is 92 and 95%, respectively (diagonal); it is the most exogenous; this result translates that Uganda's economy is the most independent in the bloc. In other words, Uganda's economy is the leading variable as shown to be the most exogenous. However, we will validate this finding using the intra-trade data between EAC member states.

**Table 7.**  
The variance decomposition estimates for East African economies between 1988 and 2019

	Horizon	KY	BY	TY	RY	UY
KY	9	30	7	17	3	43
BY	9	3	56	6	1	34
TY	9	32	12	34	4	18
RY	9	30	17	24	7	22
UY	9	1	3	1	3	92
KY	3	38	6	8	3	46
BY	3	1	70	7	2	20
TY	3	40	11	38	4	8
RY	3	43	4	8	19	27
UY	3	0	1	3	2	95

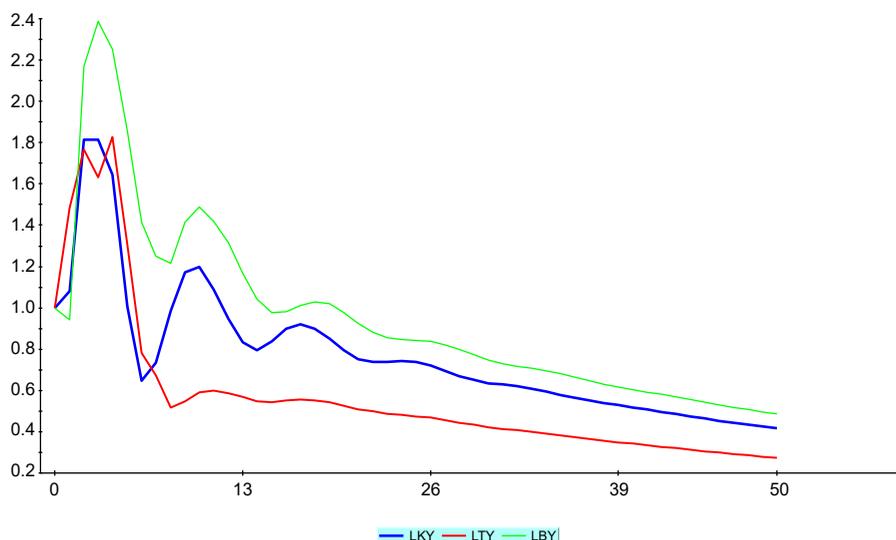
Thus, in a simple language, it implies that the economy of Uganda is not much dependent on other EAC member countries in terms of export to generate earnings for its GDP; therefore, it can sustain itself without relying upon export in the bloc. This scenario can be partly influenced by the fact that Uganda is also enjoying substantial trade relationships with other countries outside the EAC bloc like Ethiopia, Djibouti, Sudan and South Sudan based on the report by the East African economic ([Regional Economic Outlook, 2019](#)). This is also in line with the lowest intra-trade volume of Uganda in the region as shown in [Table 8](#), where Uganda's trade share experiences a negative balance of trade within the EAC bloc but with the highest imports in the region.

Please notice that it should be understood from here that the concept of strong leader or weak follower in this sense should not be confused with the stronger or weaker in terms of its economic capacity; the two concepts as applied in this context is used to explain the dependability of one economy on the other; in other words, they explain the ability to sustain any economic shocks that may originate from other countries in the region. That is why; despite Kenya's economy being the strongest as compared to the rest in the region. But its earning is highly attributed to intra-trade export earnings as compared to others in the region. For instance, during the year end of 2010, the net intra-trade balance (net gain from intra-trade) of Kenya was approximately 3% of its GDP [3], which implies that intra-trade contributed to about 3% as a result of economic cooperation, while Uganda followed by Rwanda reported a negative intra-trade balance (loser in terms of intra-trade).

By analogy, at least, in a short period, the economy of Kenya may be affected in one way or another due to economic shocks that may originate from other member states. Why! Because if the economies of the rest of the member states are shocked to the extent that affects their ability to import from the region, Kenya will lose in terms of economic benefits (earning from export) which it has been accruing from trading with the partner states which may take some time before being adjusted to accommodate itself see also [Figure 1](#).

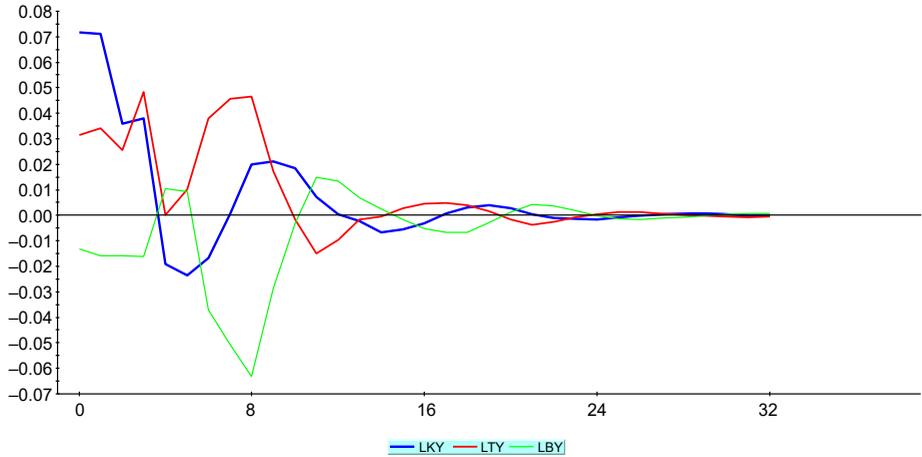
Moreover, the persistency profile [Figure 1](#) shows the extent of impacts when the entire cointegrating relationship is disturbed. It will take, at least, eight years to return to the

**Persistence Profile of the effect of a system-wide shock on the long run relations**



**Figure 1.**  
Persistence profile for  
of the effect of the  
system-wide shock on  
the long-run relations

Generalized Impulse Response(s) to one S.E. shock in the equation for LTY



**Figure 2.** Orthogonalized impulse response to one SE shocks on GDP of Kenya (LKY)

original equilibrium. Referring to the results in Table 5 where the GPD proxy for Kenya (LKY) is endogenous, now compare it with Figure 1; LKY is taking a longer recovery period as compared to the GDP proxy of Burundi (LBY) for instance, which was observed earlier to be among the exogenous. Given the fact that all three cointegrating relations pose a stronger tendency to converge to their original equilibria, the speed at which variables converge to their original equilibria are mixing, such that in less than three years (short-run) LBY is quicker followed by LKY, but after approximately seven years LTY is faster than the two.

The IR related to the shock on the GPD of Tanzania (LTY) is shown in Figure 2. It indicates that the LTY shock has stable impacts on the level of several other series. Such that when the LTY is shocked, it might pose a negative effect on other economies. For instance, LTY shock causes the GDP proxy of Burundi to be hit hard and becomes negative, followed by the GDP proxy of Kenya. After, at least, three years, the GDP proxies of Kenya and Burundi will partially recover from the shock. After 24 years, all economies will, ultimately, restore the initial level.

### 5. The economic interpretation of the cointegration test's findings to other economic variables

We have associated the findings of the cointegration tests with other economic variables such as the intra-trade among the EAC member countries. The purpose of this association is to

Country	Total export (ex)	Total import (im)	Net BoT (ex-im)	Percentage (ex)	Percentage (im)
Kenya (KY)	20,273,124,700.00	4,195,740,224.00	16,077,384,476.00	54%*	15%
Tanzania (TY)	7,444,912,111.00	5,905,391,245.00	1,539,520,866.00	20%	21%
Uganda (UY)	8,243,325,201.00	11,439,475,226.00	-3,196,150,025.00	22%	41%*
Rwanda (RY)	1,754,847,562.00	6,371,298,963.00	-4,616,451,401.00	5%	23%
Grand total	37,716,209,574.00	27,911,905,658.00	9,804,303,916.00	100%	100%

**Table 8.** Intra-trade on for East Africa member states between 1995 and 2018 amount is US\$

Source(s): COMTRADE (2018)

analyze how the findings can be partly validated using the selected economic data. In this scenario, we prefer to use intra-trade transactions [Table 8](#). This is because the FTA, which is implemented through customs union protocol, is the most evident among the four pillars for the establishment of the EAC. Moreover, based on [Italiana \(1994\)](#), the benefit of integration is taking place through increased volume of trade.

Recall the output from [Table 6](#) where Kenyan GDP (KY) is observed to be endogeneous (most dependent). This is consistent with the output in [Table 8](#), where Kenya is the highest earner in the EAC trading bloc among all members, accounting for almost more than 53% of the total intra-trade export in the region between 1995 and 2018. Kenya is having the highest positive net intra-trade balance of more than 163% out of the total net balance of trade, followed by Tanzania with only 0.16%; the rest of the countries experience negative net intra-trade balance.

Moreover, the VDC output [Table 7](#) revealed that Uganda is the most exogenous (most independent). This result, when linked to the intra-trade among the EAC countries [Table 7](#), affirms that Uganda import is the highest in the bloc. On the other hand, Uganda is the highest net consumer (importer) in both monetary terms and percentage wise, which further signifies that Uganda does not depend entirely on the EAC bloc for its earning on export (inflow) to its GDP but rather for its imports (outflow). Thus, the export from the region has little contribution to its GDP.

This further implies that any economic shock that would originate from Uganda's economy might negatively impact the rest of the EAC member states in the short run before they have to adjust to accommodate the situation. This is most likely to hit individual member countries where Uganda's import is highest, as the country's import in the region accounted for 41% of the total intra-trade import, the highest as compared to the rest, which entails that Uganda provides a good market for other member states.

Even though it might be argued that Uganda's import which is the highest in the region, could have a contribution to its GDP in the long-run, however, this could be possible if such importation involved capital goods purchase; yet, most of its imports from the region involve consumer goods, most likely the agricultural products; so it is hard to ascertain that it has any visible impact on its GDP.

This finding is further supported by the outputs in [Table 9](#) when the inter-regional trade data were randomly selected from 1971 to 1976 to include only three countries that formed

Export (ex)	1971	1972	1973	1974	1975	1976	Total	Net trade balance	% of the total (ex)	% of the total (im)
Kenya (KY)	30.2	25.6	23.1	22.1	20.8	15.7	137.5	106.1	67%*	10%
Tanzania (TY)	9.9	5.8	6.6	7.3	6.3	5.9	41.8	-13.1	20%	18%
Uganda (UY)	9.5	7.8	4.3	3.2	1.5	0.5	26.8	-186.9	13%	71%*
Total export	49.6	39.2	34	32.6	28.6	22.1	206.1	-	-	-
Import (im)										
Kenya (KY)	7.9	7.1	5.6	5	2.8	3	31.4	106.1	67%	10%
Tanzania (TY)	11.4	11.3	9.7	6.6	7.1	8.8	54.9	-13.1	20%	18%
Uganda (UY)	23.6	29.8	40	39.3	35.6	45.4	213.7	-186.9	13%	71%
Total import	42.9	48.2	55.3	50.9	45.5	57.2	300	-	-	-

Source(s): [Ravenhill \(1979\)](#) with minor modification

**Table 9.**  
Inter-regional export and imports as a percentage of partners' total intra-trade balance 1971–1976

EAC during that period, namely, Kenya, Tanzania and Uganda. Yet, Kenya is the only EAC member which reported a positive intra-trade balance, while the rest posted a negative balance (ninth column). It appears the endogeneity (dependence) of Kenya on other partners for earning has been historically and dominant in terms of trading relationships, where it has been experiencing the highest export earnings in the East Africa bloc. Kenya has been disproportionately benefiting from regional integration and enjoyed about 67% shares of the total inter-regional export between 1971 and 1976. Similarly, Uganda appears to be the leading consumer (exogenous), even between these periods, having the highest import share of 71% of the total intra-trade imports in those periods.

Again, the output in Table 6 revealed a significant negative short-run relationship between Tanzania and Kenya, and this also can be related to the intra-trade data in Table 10, where Tanzania is the second-highest with a positive net intra-trade balance just below Kenya. Thus, Tanzania has a negative net intra-trade balance with Kenya. This further implies that any worse economic relation between the two members can significantly impact their economies. This finding is important for the policy implication of the partner states in the region.

## 6. Conclusion

This paper examined the long-run economic relationships of the East Africa economic integration, which is commonly known as the EAC. To achieve the study's goal, we employed the Johansen cointegration technique by utilizing time-series data, including the recently developed cointegration techniques such as LRSM, which was developed by Pesaran and Shin. The annual GDPs proxies were used for performing the cointegration test. The study is based on the prior information that integration promotes economic growth. However, to realize the effective growth effects, it is pre-supposed that the economy must be cointegrated.

The study found both long-run and short-run cointegration at I(1). The finding further revealed a negative economic relationship between Tanzania and Kenya in the short run, which is statistically significant. Moreover, it revealed positive and significant short-run economic relationships between Rwanda and Burundi and also between Kenya, Burundi and Uganda. But as for Uganda and Rwanda, it indicates an insignificant short-run economic relationship.

Moreover, it was observed that there is high economic disparity for Burundi and Rwanda with the other three partner states; this can be partly because Burundi and Rwanda officially joined the EAC latest during 2007s; however, the economies of the two countries keep on improving year after year more than they used to be before joining the EAC. Other factors may include the size of these countries that can determine the size of resources such as labor forces and land areas, as these economies are most dependent on agrarian economies (Badinger, 2001).

The result of the study would have some following policy implications. Based on the study's finding that the economies of the EAC member states are cointegrated, which further

Partner states	Export (ex)	Import (im)	BOT (\$)
Burundi (BY)	625,826,190.00	13,276,273.00	612,549,917.00
Kenya (KY)	4,439,294,453.00	5,347,464,275.00	(908,169,822.00)
Rwanda (RY)	1,330,689,527.00	17,991,239.00	1,312,698,288.00
Uganda (UY)	1,049,101,941.00	526,659,458.00	522,442,483.00
Grand total	7,444,912,111.00	5,905,391,245.00	1,539,520,866.00*

**Note(s):** This table shows the exports and imports of Tanzania to the rest of the EAC countries

**Source(s):** COMTRADE (2018)

**Table 10.**  
Intra-trade between  
Tanzania and other  
EAC countries from  
1995 to 2018

implies that in the long run, the EAC economies will move together or have an addiction to each other. Thus member countries should commit themselves to the protocols of the integration by supporting and timely resolving any anomalies that may affect the relationship between the member states. Owing to their interdependence, the anomalies originating from two or more states may result in creating unfavorable relations, which may impact the economy of the individual state.

To achieve a persistent economic growth effect of the EAC integration, there should be an improved productivity gain with less restriction on cross-border trading, including human and capital movements coupled with a highly political will, and also using the EAC organs as liaisons to facilitate mending any unfavorable diplomatic relationships between member states. Because many of these unfavorable diplomatic relations affect peoples' movements and trade flow between the partner states, hence impeding the overall gain in economies.

The need to implement the single currency mechanism will facilitate trade flow by reducing foreign exchange barriers and will promote economic transactions among the member countries. To boost the economic growth and other fiscal issues of the member countries, the policymakers of the region should consider establishing the East Africa regional development bank.

There is also a need to reformulate a well-integrated market in the region to resolve the current economic and trading imbalances, as it was observed that Kenya is highly benefiting by exploring the EAC market for its exports. Other member countries should explore the EAC bloc to improve their competencies. Because, if this imbalance prevails, in the long run, it may lead to disputes among the member states as it happened in the past leading to the demise of the former EAC. If the appropriate mechanisms are not established by political means to resolve this inequality, regional integration will certainly fail to sustain.

Hence, policymakers in the region should seek to contemplate the regional integration utterly to lessen any diplomatic and intra-trade fiascos by setting primacy to cover the demand/supply gaps/shortages of one country to another primarily from within the region based on comparative advantages.

On top of that, there is a need for further studies to examine to what extent regional integration affects the growth of the individual economy in the EAC context; also, an empirical study is needed to analyze how the border issues and or diplomatic misunderstanding affect the overall economic relationship of the member states. Last but not least, further study is needed to examine the macro-economic convergence in the region especially using the GDP variable of the member states.

## Notes

1. <https://databank.worldbank.org/data/download/GDP.pdf>.
2. <https://www.eac.int/overview-of-eac>.
3. <https://unctad.org/publications>.

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