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The Long Run Stability of Money in the Proposed East African Monetary Union [1]

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The Long Run Stability of Money in the Proposed East African Monetary Union

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Abstract

This study investigates the stability of money in the proposed East African Monetary Union (EAMU). The study uses annual data for the period 1981 to 2015 from five countries making up the East African Community (EAC). A standard money demand function is designed and estimated using a bounds testing approach to co-integration and error-correction modeling. The findings show divergence across countries. This divergence is articulated in terms of differences in CUSUM (cumulative sum) and CUSUMSQ (CUSUM squared) tests, short run and long term determinants and error correction in event of a shock. Specifically, the results show that the demand for money is stable in the cases of Burundi, Rwanda and Tanzania based on the CUSUM and CUSUMSQ tests, while for the remaining countries (Kenya and Uganda) only partial stability is apparent. In event of a shock, Kenya will restore its long run equilibrium fastest, followed by Tanzania and Burundi.

Keywords: Stable; demand for money; bounds test
JEL classification: E41; C22; O55

1. Introduction

This study which is positioned on assessing the long run stability of money in the proposed East African Monetary Union (EAMU) is motivated by three main tendencies in scholarly and policy circles, notably: (i) the policy relevance of understanding the future of monetary stability in the EAMU; (ii) debates in the literature on monetary policy effectiveness in the light of the stability of the demand for money and (iii) gaps in the attendant literature. These motivations are substantiated in chronological order.

First, on the policy front, the recent European Monetary Union (EMU) crisis and subsequent negative externalities have shown that monetary arrangements that are not designed to be robust to a plethora of macroeconomic shocks are characterized by serious disequilibria (Asongu, 2013a). Against this background, it is important to understand the future stability of money in the proposed EAMU.

Second, the relevance of interest rates as a monetary policy instrument in relation to the stability of the demand function for money is still open to debate (Asongu, 2016). Building on the premise that monetary policy is connected to the nature of money demand; some strands in the literature maintain that money supply can be influenced through appropriate monetary policy instruments when the demand for money is stable (Poole, 1970). According to the narrative, the use of interest rate as an effective monetary policy instrument is feasible when the demand for money is stable. Hence, money supply is ineffective due to an unstable demand for money. This is essentially because money supply is assumed to be effective when the demand for money is stable (Folarin & Asongu, 2019).

Conversely, there is another strand of the literature maintaining that it is inappropriate to use interest rates as a policy instrument by the central banks of developing countries owing to the stability of the demand for money (Rao & Kumar, 2009). According to this strand, given that it is not easy to predict a money demand function, the interest rate can be adapted to the corresponding unstable demand function. This is essentially because; determinants of money (such as opportunity and scale variables) may not convey substantial information about money demand, partly because opportunity variables reflect information on the forgone alternative of holding money. Given that the interest rate is an example of such an opportunity variable, the demand function of money can be responsive to changes in interest rate and hence translate into some difficulty in predicting the demand for money. It is on the basis of this difficulty in predicting the demand for money that interest rates can be leveraged as monetary policy instruments (Folarin & Asongu, 2019).

In another strand of the literature, Weeks (2010) has established that the mainstream approach of monetary policy is inappropriate in African countries given that governments do not have the instruments with which to render monetary policy effective. According to Weeks, a region such as sub-Saharan Africa lacks fundamental mechanisms with which to implement monetary policy, especially as it pertains to: (i) the influence of private credit via channels like open market operations and (ii) the attempt to affect borrowing rates in the private sector through the adjustment of interests rates at which central banks can lend to

commercial banks. The inappropriateness of monetary policy is seen from the perspectives of traditional discretionary monetary policy arrangements as well as alternative arrangements which are conducive for price stability and economic growth. It is important to note that, in the perspective of discretionary policy, policy instruments can be used by monetary authorities to offset adverse shocks to output through the pursuit of either: (i) a contractionary monetary policy (i.e. when the economic output is above its potential) or (ii) an expansionary monetary policy (i.e. when output is below its potential). This narrative is consistent with the mainstream literature on using inflation targeting for countercyclical monetary policy (Ghironi & Rebucci, 2000; Mishkin, 2002; Cavoli & Rajan, 2008; Cristadoro & Veronese, 2011; Levine, 2012; Asongu, 2014a).

Third, while there is an evolving stream of literature on the stability for money demand in developing countries (Folarin & Asongu, 2019), the literature is spares on the proposed EAMU. According to some scholarly perspectives, financial innovation which is indispensible due to financial globalization (Asongu, 2015; Batuo & Asongu, 2015) has increased the instability of the demand for money in developing countries. Some examples of studies supporting this position include: Nyamongo (2015) for Kenya, Kumar (2011) for twenty developing countries and Nachega *et al*. (2001) for Uganda. As discussed in Section 2 below, the literature on the potential EAMU has fundamentally focused on assessing whether the embryonic monetary zone is feasible or not. The dominant discourse from the studies is that the potential monetary zone is not feasible in the short run. This dominant inference has been derived from investigating heterogeneity from empirical analyses of variables employed to assess fiscal, real and monetary convergence (Drummond *et al*., 2015a, 2015b; Asongu, 2014b, 2014c; Lepetit *et al*., 2014; Mafusire & Brixiova, 2013; Davoodi *et al*., 2013; Rusuhuzwa & Masson, 2012; Buigut, 2011). In essence, the dominant view from the results is a selection framework of monetary integration. This entails the direct disqualification of some nations or the identification of clusters. For example, in the old East African Community (EAC) or in the new EAC sample, Rwanda and Burundi (see Bangaké, 2008; Mkenda, 2001) and Rwanda (see Lepetit *et al*., 2014; Sheik *et al*., 2011) are excluded, respectively. Moreover, because of the absence of a robust mechanism by which to absorb asymmetry shocks, Drummond *et al*. *et al*. (2015b) posit that Rwanda should be excluded from the currency union.

This study extends the extant literature (articulated in the third strand) by contributing to the debate on monetary policy effectiveness (discussed in the second strand), in order to

provide insights into the relevance of monetary policy stability in the proposed EAMU (engaged in the first strand). The present study employs the autoregressive distributed lag (ARDL) bounds test approach to cointegration from Pesaran *et al.* (2001). Hence, the procedure is used to assess whether there is a long-run nexus between an aggregate of money (i.e. M2) and its corresponding determinants. The findings show divergence across countries in the stability of money. The closest studies to the current paper are Asongu et al. (2019a) and Asongu et al. (2019b) which have focused respectively, on the proposed West African Monetary union and Southern African Monetary union. The focus of the present study also departs from extant studies on money demand especially on the effectiveness of monetary policy in the face of unstable money demand (Kuman et al., 2013; Bahmani-Oskooee & Rehman, 2005) and country level money demand stability analyses (Halicioglu & Ugur, 2005; Oskooee and Gelan, 2009; Drama & Yao, 2010).

The rest of the study is structured as follows. The literature review is discussed in Section 2 while Section 3 covers issues pertaining to the data and methodology. The empirical results are presented and discussed in Section 4 whereas Section 5 concludes with implications and future research directions.

2. Literature review

Consistent with Asongu *et al.* (2017), it is important to begin this narrative by briefly highlighting the historical context of the African Union (AU) and corresponding embryonic regional monetary zones. Accordingly, the fundamental principle of the AU is encapsulated in the African Economic Community (AEC) or Abuja treaty (signed on the 3rd of June 1991), which requested the creation of the African Central Bank by 2018, contingent on the creation of an African Economic Community. It follows that the African Monetary Union (AMU) is broadly defined within the scope of an Economic and Monetary Union to be managed for the interest of nation states within the AU by a proposed African Central Bank. It is important to note that the creation of a currency area in Africa is not an event but a process that entails the amalgamation of potential regional monetary unions, *inter alia*, the proposed: Southern African Monetary Union; West African Monetary Union and EAMU. In what follow, we discuss the existing literature on the embryonic EAMU.

On the premise of a treaty signed by Kenya, Tanzania and Uganda, the East African Community (EAC) was founded in 1999. The treaty embodied the creation of a monetary

union and later a political union between member states for the purpose of harmonizing monetary and political decisions. Burundi and Rwanda integrated the community later. A stepping stone to the common monetary zone is a customs union that was founded in 2005. The currency union which was proposed to be adopted in 2012 has been postponed (Miles, 2015).

Table 1: Summary of empirical studies on the proposed East African Monetary Union

Author(s)	Period	Countries	Methodology	Feasibility	Justification/ recommendation
Mkenda (2001)	1980-1998	Kenya, Tanzania, Uganda	Generalized Purchasing Power Parity (GPPP) model.	Yes	Cointegrated real exchange rates between member states.
Buigut & Valev (2005)	1970-2001	Kenya, Tanzania, Uganda, Burundi, Rwanda (EAC)	Structural vector autoregressive analysis.	No	Asymmetric demand and supply shocks.
				Yes, with more integration	Similar speed and magnitude in adjustment of shocks.
Bangaké (2008)	1990-2003	21 African countries	System of simultaneous equations and GMM.	Yes	Yes for Kenya, Tanzania, Uganda (structural similarities).
Buigut & Valev (2009)	1990-2004	EAC	Simulation of welfare effects from a monetary union	Not definite	Mutual restraint in monetary policy is a potential benefit.
Falagiarda (2010)	1990-2006	EAC	Cointegration analysis.	Yes/No	Single currency viable but currently doubtful.
Buigut (2011)	1997-2008	EAC	Cointegration techniques on exchange rates and monetary base.	No	Only partial convergence.
Kishor & Ssozi (2011)	1970-2007	EAC	Unobserved component model and time-varying parameter model.	Yes/No	Increased but weak business cycle synchronisation since 2000.
Sheik *et al.* (2011)	1980-2010	EAC	Cross country correlation and variance analysis.	Yes/No	Similar business patterns, but for Rwanda.
Rusuhuzwa & Masson (2012)	1990-2010	EAC	Correlation and cointegration of business cycle and shocks.	No	Substantial asymmetric shocks and production structures.
Davoodi *et al.* (2013)	2000-2010	EAC	Structural vector auto-regression analysis (SVAR)	No	Weak Monetary Policy Transmission Mechanism.
Asongu (2013b)	1980-2010	EAC	Granger causality.	Yes	Traditional monetary policy instruments.
Mafusire & Brixiova (2013)	1980-2009	EAC	SVAR	No	Lack of macroeconomic convergence.
Lepetit *et al.* (2014)	2003-2010	EAC	Stylised model of policymakers' decision problem	No	Uncertainty does not allow for monetary and financial stability.
Asongu (2014b)	1981-2009	EAC	GMM	No	Lack of real, monetary and fiscal policy convergence.
Asongu (2014c)	1980-2010	EAC	VAR	No	Ineffective Monetary policies.

Notes. VAR: Vector autoregressions. GMM: Generalised Method of Moments.
Source: Asongu et al. (2017)

In 2013, member states of the EAC entered into a protocol which defined the process and criteria of convergence imperative for a single currency area in the economic community (Drummond *et al.*, 2015a, 2015b). The protocol articulated more steps needed for the consolidation of regional integration after the ratification of two protocols that have been adopted in the past, notably: the customs union in 2005 and the common market in 2010. The

roadmap suggests that a common currency area should be in place by 2024. Whereas there is a plethora of rewards linked to the underlying economic integration and currency union, there are still some significant challenges to the process of harmonizing the currencies of individual nations.

Consistent with Asongu *et al*. (2017), while the implementation of protocols essential for the customs union and common market are yet to be completed, there is still an over-ambitious monetary policy convergence criterion. According to the narrative, the corresponding empirical studies pertaining to the embryonic EAMU can be summarized in the light of Hegelian dialectics, namely: (i) a thesis consisting of studies which support the case for the feasibility of the proposed monetary union (Bangaké, 2008; Mkenda, 2001; Asongu, 2013b); (ii) an anti-thesis which summarizes studies that are not in support of the monetary union (Rusuhuzwa & Masson, 2012;Buigut, 2011; Mafusire & Brixiova, 2013; Davoodi *et al*., 2013; Asongu, 2014b, 2014c; Lepetit *et al*., 2014) and (iii) a synthesis for studies which have supported the currency union, contingent on more policy harmonizing efforts by member states (Sheik *et al*., 2011; Kishor & Ssozi, 2011; Falagiarda, 2010; Buigui & Valev, 2005). For lack of space, more insights into the extant empirical studies (which are distinct in terms of periodicity, authors, methodology and sampled countries) are available in Asongu *et al*. (2017).

3. Data and Methodology

3.1 Data

This study uses annual data for the period 1981 to 2015 from five countries making up the EAC, namely: Rwanda, Burundi, Tanzania, Kenya and Uganda. The data is from the World Development Indicators (WDI) and the International Financial Statistics. The variables used which are consistent with the recent literature (Folarin & Asongu, 2019) include: real broad money (or M2); real gross domestic product (GDP), real effective exchange rate, foreign exchange rate and inflation rate. The full definitions of variables and corresponding sources are disclosed in Table 2.

(i)Real GDP is GDP divided by the GDP deflator. It is the monetary value corresponding to commodities produced within a country over a period of time and evaluated at constant price. Accordingly, real GDP is used to appreciate real income.

(ii)Real broad money is nominal broad money divided by the GDP deflator. It denotes narrow money plus savings and time deposits with commercial banks evaluated at constant price. It is important to note that real broad money and real GDP are obtained by dividing the broad money and the GDP respectively by the consumer price index.

(iii) The inflation rate is the GDP deflator. The inflation rate is defined as the percentage change in the consumer price level.

(iv)The exchange rate is the official exchange rate in local currency units relative to the United States Dollar.

(v) Foreign interest rate is a three month treasury bill, which is a short term interest charged on government security. The first four variables are from World Development Indicators while the fifth is from the International Financial Statistics.

Table 2: Data definitions and sources

Variables	Full names	Definitions	Sources
RM2	Real broad money	Nominal broad money divided by GDP deflator	World Development Indicators (WDI)
RM1	Real narrow money	Nominal narrow money divided by GDP	World Development Indicators (WDI) and International Financial statistics (IFS)
RGDP	Real GDP	Gross domestic product divided by GDP deflator	World Development Indicators (WDI)
INFL	Inflation rate	GDP deflator (Annual %)	World Development Indicators (WDI)
EXCH	Exchange rate	Official exchange rate - local currency units relative to the U.S. dollar	World Development Indicators (WDI)
UKINTEREST	Foreign interest rate	Three month treasury bill rate	International Financial statistics (IFS)

Notes: The data used for the study span over the period 1981 to 2015. RM2: Real broad money. Real GDP: Real Gross Domestic Product. INFL: Inflation rate. EXCH: Exchange rate. UKINTEREST; Foreign interest rate.

Table 3 presents the summary statistics. From the table it is apparent that the variables display a substantial degree of variation, such that we should be confident that reasonable estimated linkages would emerge in the assessment of the stability of money demand in the proposed EAMU.

Table 3: Descriptive statistics of East African Community (EAC)

		RM1'Billion	RM2'Billion	RGDP'Billion	INFL	EXCH	UKINTEREST
	Mean	1.93	2.54	12.7	10.49	654.40	6.36
Burundi	Max	3.18	4.15	17.9	38.94	1571.90	14.64
	Min	1.12	1.27	9.50	-6.06	90.00	0.30
	Std dv	0.61	0.86	2.22	9.15	526.01	4.26
	Mean	3.73	7.95	21.7	10.69	54.42	6.36
Kenya	Max	8.32	17.0	40.6	41.99	98.18	14.64
	Min	1.65	3.41	11.8	0.93	9.05	0.30
	Std dv	2.07	3.79	7.95	7.68	28.58	4.26
	Mean	2.09	4.28	25.5	8.28	342.51	6.36
Rwanda	Max	4.20	12.8	59.5	51.27	720.98	14.64
	Min	1.37	1.98	8.81	-7.02	76.45	0.30
	Std dv	0.77	2.77	13.1	10.48	1.41	4.26
	Mean	26.1	42.0	194	14.15	739.57	6.36
Tanzania	Max	62.3	107	441	31.17	1991.39	14.64
	Min	12.6	10.0	81.8	4.60	8.28	0.30
	Std dv	14.6	27.2	103	8.16	589.07	4.26
	Mean	26.2	40.4	226	36.12	1267.26	6.36
Uganda	Max	67.9	115	533	189.98	3240.65	14.64
	Min	5.48	5.56	81.4	-5.32	0.50	0.30
	Std dv	20.9	34.9	143	51.75	926.29	4.26

Notes: RM2 is real broad money; RGDP is real gross domestic product; INFL is inflation rate based on GDP deflator; EXCH is exchange rate; UKINTEREST is UK interest rate.

3.2 Methodology

Consistent with recent literature (Bahmani-Oskooee & Gelan, 2009), on the theoretical underpinnings motivating an empirical assessment of the stability of the demand for money, the Hossain (1993, pp. 91) approach is adopted for this study. Hence, real income is used as the scale variable whereas opportunity variables include inflation and interest rates. In accordance with Bahmani-Oskooee and Gelan (2009), using interest rate as an opportunity variable in Africa could mislead policy given that the financial sector is not well developed. The authors have argued that nations that are characterized with financial sectors that are relatively less developed are also characterized with a tendency in which the full market conditions are not reflected by the interest rate. In order to remedy this draw-back, the authors have recommended the use of inflation rate. The extant literature has exclusively controlled for interest rates (Anoruo, 2002; Akinlo, 2006) or controlled for both inflation and interest rates (Kumar et al., 2013). In this study, we control both.

The literature on money demand has also articulated the relevance of taking into account foreign interest rates as well as currency substitution in the assessment of the demand function of money (Folarin & Asongu, 2019). For instance, Chaisrisawatsuk et al. (2004) emphasized that in so far as foreign bonds are considered by citizens as an alternative

investment channel, the anticipated return on the underlying investment should influence the demand for money. It is important to note that the impact of exchange rate on money demand is reflected by currency substitution while the relevance of foreign interest rates on money demand is captured by the capital mobility impact.

In the light of above underpinnings, the demand for money in this study is expressed as follows:

$$M/P = f(y, op, R^f, E), \quad (1)$$

where M/P is real monetary aggregate, M is nominal monetary aggregate, p is price level, y is income variable, op are opportunity variables in terms of domestic interest rate (R^d) and inflation (INF), R^f is foreign interest rate and E is real effective exchange rate.

Equation (1) can be re-expressed in a double log form as follows:

$$(\ln(M/p)_t = \beta_0 + \beta_1 lny_t + \beta_2 R^d{}_t + \beta_3 INF_t + \beta_4 R^f{}_t + \beta_5 \ln E_t + \varepsilon_t \quad (2)$$

where, *ln* is natural logarithm, y is real income, R^d is domestic interest rate, INF is inflation rate, β's are the coefficients for the variables considered in the study, ε is the residual term and *t* is time.

Given that the variables in Equations (2) are in time series, it is relevant to test their corresponding stationary properties in order to avoid spurious regressions. The properties of stationarity are tested using the Phillips-Perron (PP) test because it has been established to be more reliable and efficient (compared to the Augmented Dickey Fuller test) when the time series is of longer periodicity (Asongu, 2014d).

Table 4: Unit Root tests

	Burundi	**Kenya**	**Rwanda**	**Tanzania**	**Uganda**
LRM1	-2.295	-1.955	-1.282	-2.468	-2.696
ΔLRM1	**-6.619*** **	**-5.750*** **	**-5.954*** **	**-3.186** **	**-5.998*** **
LRM2	-2.674	-2.358	-0.479	-2.117	-2.433
ΔLRM2	**-7.783*** **	**-6.954*** **	**-4.433*** **	**-3.600** **	**-6.061*** **
LRGDP	-1.507	-0.725	-1.405	-0.247	-3.598**
ΔLRGDP	**-3.456** **	**-3.301** **	**-5.986*** **	**-3.576** **	
INFL	**-4.671*** **	**-4.540*** **	**-4.065** **	-2.514	-2.218
ΔINFL				**-7.280*** **	**-5.199*** **
LEXCH	-1.118	-1.460	-1.604	-1.251	-2.404
ΔLEXH	**-3.618** **	**-4.747*** **	**-4.796*** **	**-3.329** *	**-3.409** **
UKINTEREST	-2.495	-2.495	-2.495	-2.495	-2.495
ΔUKINTEREST	**-6.320*** **	**-6.320*** **	**-6.320*** **	**-6.320*** **	**-6.320*** **

Notes: *, **, *** are significance levels of 10%, 5% and 1% respectively. RM1is real narrow money; RM2 is real broad money; RGDP is real gross domestic product; INFL is inflation rate based on GDP deflator; EXCH is exchange rate; UKINTEREST is UK interest rate. The reported values are the corresponding t-statistics.

From the unit root tests results disclosed in Table 4, it is apparent that the variables are stationary both at levels and first difference. This implies that the ARDL approach is appropriate. In the light of the above, the ARDL bounds test procedure developed by Pesaran *et al*. (2001) is used to examine if the variables are cointegrated or have a long run relationship. The advantage of the test over other estimation procedures (e.g. Johansen and Engle & Granger tests) is that variables are not required to display the same order of integration. The corresponding ARDL model is specified in Equation (3) as follows:

$$\Delta(\ln(M/p)_t = \delta_0 + \delta_1(\ln(M/p)_{t-1} + \delta_2 lny_{t-1} + \delta_3 R^d{}_{t-1} + \delta_4 INF_{t-1} + \delta_5 R^f{}_{t-1} + \delta_6 lnE_{t-1} + \delta_7 Trend + \sum_{j=1}^{l} \tau_{1j} \Delta(\ln(M/p)_{t-j} + \sum_{j=0}^{m} \tau_{2j} \Delta lny_{t-1} + \sum_{j=0}^{n} \tau_{3j} \Delta R^d{}_{t-1} + \sum_{j=0}^{n} \tau_{4j} \Delta INF_{t-1} + \sum_{j=0}^{o} \tau_{5j} \Delta R^f{}_{t-1} + \sum_{j=0}^{p} \tau_{6j} \Delta lnE_{t-1} \varepsilon_t \quad (3)$$

In the ARDL technique, Equations (3) is estimated for the purpose of performing the Bounds test. The Schwarz Information Criterion (SIC) is used to determine the optimal lag used for each variable. While there are other approaches in determining the optimal lag such as the Akaike Information Criterion (AIC), the Hannan-Quinn Criterion (HQ) and the Adjusted R-squared. Our choice of Schwarz Information Criterion (SIC) was informed by the need to perform the regression analysis using the most parsimonious lag structure given the small sample size of the study. The Fisher (F)-statistics is then estimated by means of the Wald restriction, notably; by assigning restrictions to the lag value of all level series in the two underlying equations (see Pesaran et al., 2001). The corresponding estimated F-statistics is used to assess evidence of a long term nexus among variables employed in the study. It is worthwhile to emphasize that the null hypothesis related to the Wald restriction that is imposed on Equation(3) is the following: $\delta_2 = \delta_3 = \delta_4 = \delta_4 = \delta_5 = \delta_6 = 0$.This reflects the presence of a long term nexus.

The value of the F-statistics is obtained by comparing the critical values at the lower and upper limits provided by Pesaran *et al*. (2001). With regard to the cointegration test, if the estimated F-statistics is higher than the critical value of the upper limit, the null hypothesis of no cointegration is rejected and the presence of a long run relationship is established. Conversely, if the estimated F-statistics falls below the lower critical value, the hypothesis of a long run nexus is not valid. In the same vein, evidence of a long-run

relationship is inconclusive if the F-statistics falls between the lower and upper critical values. The findings of the cointegration tests in Table 5 show that evidence of cointegration is apparent in four out of the five selected Eastern African Community (EAC) countries, namely, Burundi, Kenya, Tanzania and Uganda. Thus, we will only perform short run analysis for Rwanda.

Table 5: Cointegration tests

Countries	ARDL structure	F-statistics	Remarks
Burundi	2,0,1,0,0	**7.507*** **	Cointegrated
Kenya	3,3,1,3,0	**5.324*** **	Cointegrated
Rwanda	1,2,0,1,0	2.331	Not cointegrated
Tanzania	3,2,0,0,0	**9.808*** **	Cointegrated
Uganda	1,0,0,0,0	**4.032** **	Cointegrated

Notes: *, **, *** are significance levels of 10%, 5% and 1% respectively.
ARDL: Autoregressive Distributed Lag.

In the light of the results obtained from the ARDL cointegration test, the Error Correction Model (ECM) is adopted to investigate the speed of adjustment back to the cointegration or long-term relationship/equilibrium in event of a short term shock for the four countries. Moreover, the ECM also enables the study to assess the effects of variables in the conditioning information set on the short-run and long-term demand for money.

Two steps make-up the ECM process. The first focuses on deriving the error correction term (ECT) by regressing the outcome variable on the independent variables and then subtracting the actual value of the dependent variable from the estimated value. This is illustrated as follows.

$$ECT = (\ln(M/p)_t - (\vartheta_0 + \vartheta_1 T + \vartheta_2 lny_t + \vartheta_3 R^d{}_t + \vartheta_4 INF_t + \vartheta_5 R^f{}_t + \vartheta_6 lnE_t) \qquad (4)$$

A trend is then introduced into the regression in the light of the trending character of the variables. The ECT that is derived from Equation (4) is fitted in Equation (2) to obtain Equation (5) which is employed to estimate the ECM. The speed of adjustment is measured by the value of τ.

This value is expected to display a negative sign in order to restore the long term relationship after an exogenous shock. It should range between 0 and minus 1, with the value of 0 indicating the absence of an adjustment whereas the value of minus 1 showing the full adjustment, one period following the exogenous shock. Conversely, a positive value denotes the absence of convergence towards the long-term equilibrium after an exogenous shock. In other words, it reflects a permanent deviation from equilibrium (Asongu, 2014e).

$$\Delta \ln(M/p)_t = \gamma_0 + \gamma_1 \Delta ln y_t + \gamma_2 \Delta R^d{}_t + \gamma_3 INF_t + \gamma_4 \Delta R^f{}_t + \gamma_5 \Delta ln E_t + \tau ECT_{t-1} + \varepsilon_t \quad (5)$$

Given that the purpose of this study is to investigate the stability of the demand for money in the EAC, we are consistent with recent literature (Akinlo, 2006; Kumar, 2011; Khan & Hye, 2013; Kumar *et al*., 2013) in employing parameter consistency analyses by means of the cumulative sum (CUSUM) and CUSUM squared (CUSUMSQ) tests of Brown *et al*. (1975). The CUSUM test linked to the cumulative recursive sum of recursive residuals, whereas the CUSUMSQ test pertains to the cumulative sum of squares of recursive residuals. The null hypothesis (which is the position of instability), is rejected when the plots related to the CUSUM and CUSUMSQ tests are significant at the 5% level. It follows that when the corresponding plots fall outside the 5% critical lines, the demand for money function is not stable.

4. Empirical results

Table 6 shows short term and long run relationships between the broad money aggregate and its determinants. Accordingly, the ARDL estimation approach also articulates the impacts of exchange rate, interest rate, inflation on the demand for money among member states of the EAC. From the second to the sixth columns of Table 6, the findings of respective countries are presented while in the seventh column; panel evidence (i.e. combining the five member states) is presented. Unlikely other EAC countries for which both short run and long term relationships are apparent, the findings for Rwanda are exclusively in terms of short run effects because we could not establish a cointegration relationship for the country. This specificity of Rwanda is broadly consistent with Drummond et al. (2015b) who has concluded that Rwanda should be excluded from the proposed union because of incapacity to cushion asymmetric shocks.

It is apparent from Table 6 that influencing the demand for money varies in the EAC. In the short run, an increase in income has a significant contemporary negative effect on the demand for money in Rwanda. In the case of Kenya and Tanzania, the contemporary effect of a change in income is positive but insignificant. However, the first lag of a change in income has a significant negative effect on money demand in Tanzania while the second lag of a change in income has a negative effect on money demand in Kenya. Furthermore, the results

show that in the short run, a change in inflation rate has a significant negative effect on money demand in Burundi and Uganda but insignificant in the cases of Kenya and Tanzania. In addition, it is seen that a change in exchange rate has a significant and positive effect on money demand in Burundi and Tanzania but the effect is significant and negative in the cases of Kenya and Uganda. Foreign interest rate (UKINTEREST) is found to exert an insignificant effect on money demand in the short run in the five countries. The value of the error correction term (ECT) coefficient significantly varies across the five countries. In the same vein, the ECT coefficient exhibits the expected negative sign. Based on the value of the ECT coefficient, it can be deduced that in event of a symmetric shock, Kenya will restore its long run equilibrium fastest, followed by Tanzania and Burundi. Uganda does not have the capacity to cushion asymmetric shocks and restore long-term equilibrium while such a possibility of restoration is not applicable to Rwanda because of the absence of a cointegration relationship.

Turning to the long-run results, it is seen that income has a significant and positive effect on money demand in the cases of Kenya and Tanzania while an insignificant effect is observed for Burundi and Uganda. More specifically, the results show that in Kenya and Tanzania, an increase in income leads to a more than proportional increase in the demand for money in the long-run. Furthermore, inflation rate has a significant and negative effect on money demand only for Burundi while the effect is observed to be insignificant in the other countries. This suggests that as the opportunity cost of holding money increases, it only leads to a reduction in the demand for money in Burundi.

On the effect of exchange rate, we find that an increase in exchange rate has a significant and positive effect on money demand in the cases of Burundi and Tanzania while the effect is insignificant in the cases of Kenya and Uganda. The findings suggest that currency substitution is associated with exchange rate appreciation in Burundi and Tanzania. In addition, we discovered that foreign interest rate has an insignificant effect on money demand in all five member states. This is broadly consistent with Bahmani-Oskooee and Rehman (2005) and Folarin and Asongu (2019) who have established that interest rate is not an appropriate measure of an opportunity variable in developing countries which have less developed financial markets.

Table 6: Long-run and short-term effects

	Burundi	Kenya	Rwanda	Tanzania	Uganda	ALL
Long-run estimation						
Constant	12.203	-10.825		**-8.392*** **	76.763	**0.460*** **
	(11.659)	(3.905)		**(1.992)**	(371.437)	**(0.094)**
LRGDP	0.330	**1.408*** **		**1.248*** **	-1.628	**0.842*** **
	(0.523)	**(0.173)**		**(0.079)**	(12.706)	**(0.130)**
INFL	**-0.037***	0.003		0.001	-0.074	**-0.017** **
	(0.021)	(0.002)		(0.003)	(0.311)	**(0.007)**
LEXCH	**0.363** **	0.042		**0.084*** **	-0.700	0.061
	(0.171)	(0.057)		**(0.020)**	(2.838)	(0.061)
UKINTEREST	0.007	0.009		0.008	-0.194	**-0.042** **
	(0.028)	(0.009)		(0.008)	(0.744)	**(0.016)**
Short-run estimation						
ΔLRM2(-1)	**-0.398** **	**0.580** **		**0.574*** **		
	(0.164)	**(0.222)**		**(0.121)**		
ΔLRM2(-2)		**0.488** **		**0.547*** **		
		(0.176)		**(0.136)**		
ΔLRGDP	0.109	0.027	**0.477*** **	0.373	-0.061	0.050
	(0.207)	(0.488)	**(0.098)**	(0.631)	(0.240)	(0.547)
ΔLRGDP(-1)		1.272		**-2.944*** **		
		(0.745)		**(0.619)**		
ΔLRGDP(-2)		**-2.116*** **				
		(0.706)				
ΔINFL	**-0.006** **	-0.001	0.000	0.000	**-0.003*** **	0.000
	(0.002)	(0.001)	(0.001)	(0.002)	**(0.001)**	(0.001)
ΔLEXCH	**0.120**** **	-0.183	**-0.257** **	**0.054*** **	**-0.026***	0.041
	(0.039)	(0.114)	**(0.115)**	**(0.015)**	**(0.015)**	(0.046)
ΔLEXCH(-1)		**-0.256** **				
		(0.119)				
ΔLEXCH(-2)		0.105				
		(0.105)				
ΔUKINTEREST	0.002	0.007	0.005	0.005	-0.007	-0.001
	(0.009)	(0.007)	(0.009)	(0.005)	(0.014)	(0.005)
ECT	**-0.331** **	**-0.858*** **		**-0.652*** **	-0.037	**-0.183*** **
	(0.141)	**(0.216)**		**(0.128)**	(0.150)	**(0.049)**
R-squared	0.932	0.990	0.482	0.995	0.982	
Normality	0.791	0.181	0.458	0.132	0.350	
ARCH test	(1) 0.582	(1) 0.067	(1) 0.892	(1) 0.633	(1) 0.227	
	(3) 0.359	(3) 0.854	(3) 0.224	(3) 0.695	(3) 0.252	
BG LM test	(1) 0.754	(1) 0.012	(1) 0.601	(1) 0.078	(1) 0.104	
	(3) 0.688	(3) 0.011	(3) 0.516	(3) 0.002	(3) 0.121	
CUSUM	Stable	Stable	Stable	Stable	Not stable	
CUSUMSQ	Stable	Not stable	Stable	stable	Stable	

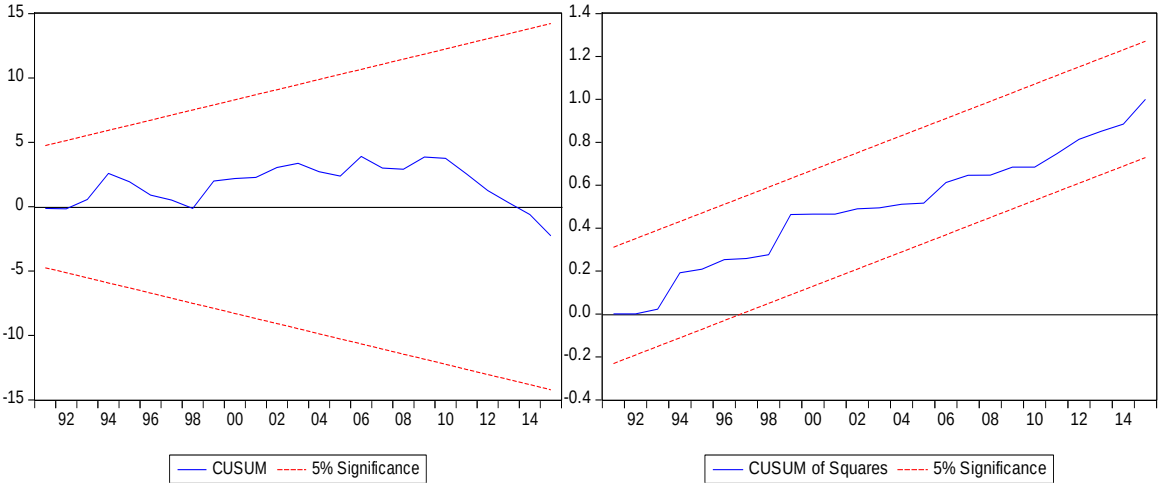
Notes: *, **, *** are significance levels of 10%, 5% and 1% respectively. RM2 is real broad money; RGDP is real gross domestic product; INFL is inflation rate based on GDP deflator; EXCH is the exchange rate; UKINTEREST is the UK interest rate and ECT is the Error correct term. CUSUM: Cumulative Sum. CUSUMSQ: CUSUM of square.The reported values in parenthesis are the standard error. The reported value for Normality test, ARCH test and BG LM test are the probability value of the f-statistics. BG is Breusch-Godfrey Serial correlation LM test

By focusing on the last column of Table 6, which is the panel evidence, we find that income has a positive and significant effect on money demand; inflation rate and foreign interest rate have negative and significant effects while the effect of exchange rate is

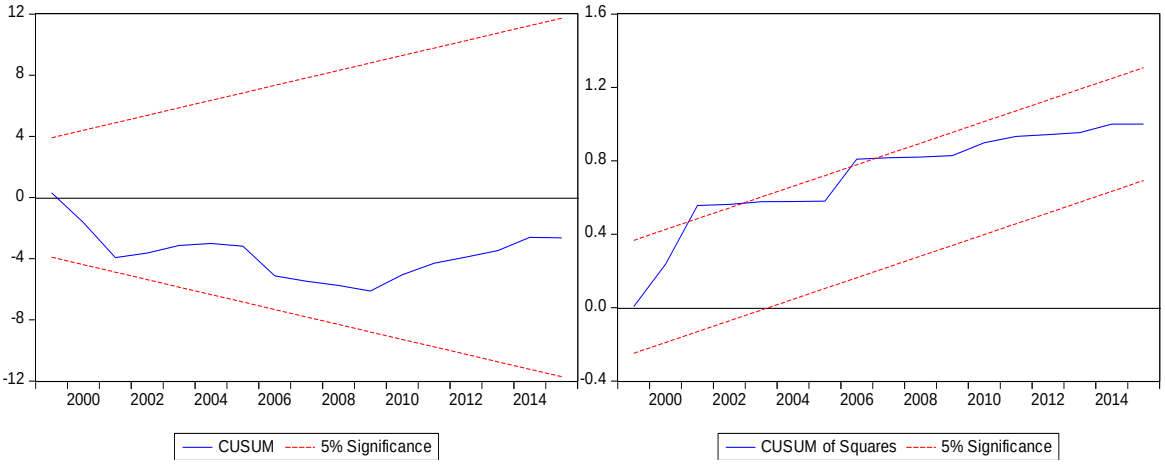
insignificant. The implication of these findings is that demand for money increases with an increase in income, which is a scale variable while the demand for money increases with a reduction in the inflation rate and foreign interest rate, which are opportunity variables.

Figure 1: The stability test results

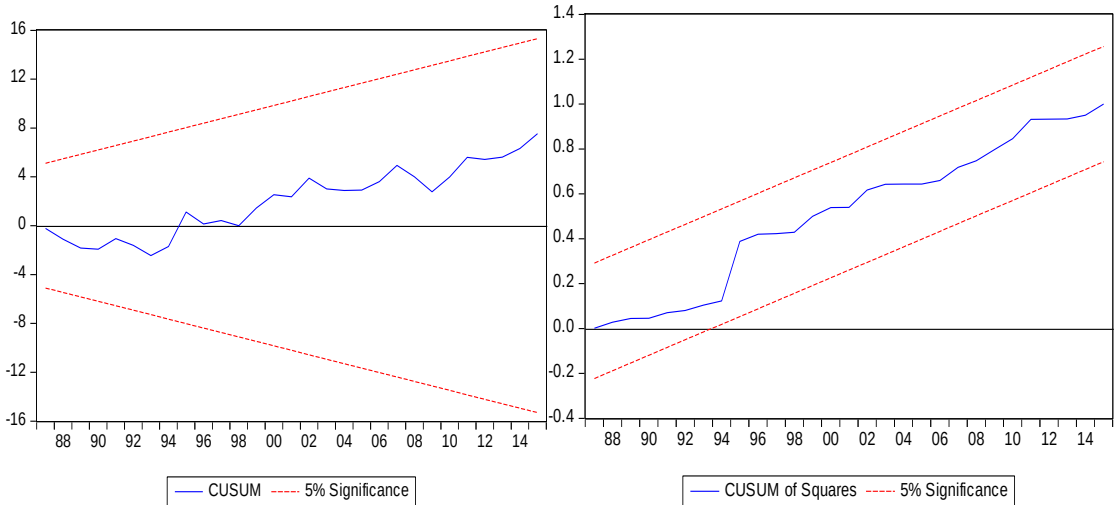
Burundi



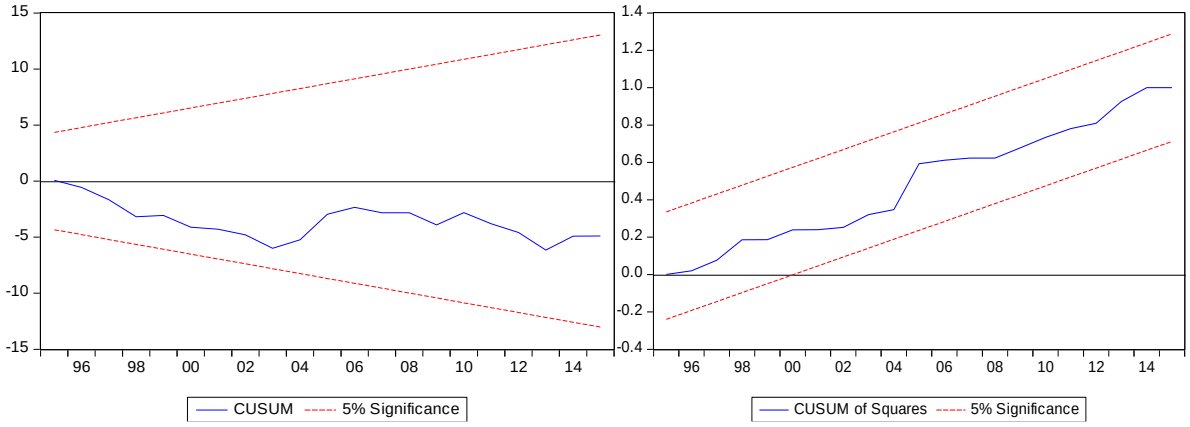
Kenya



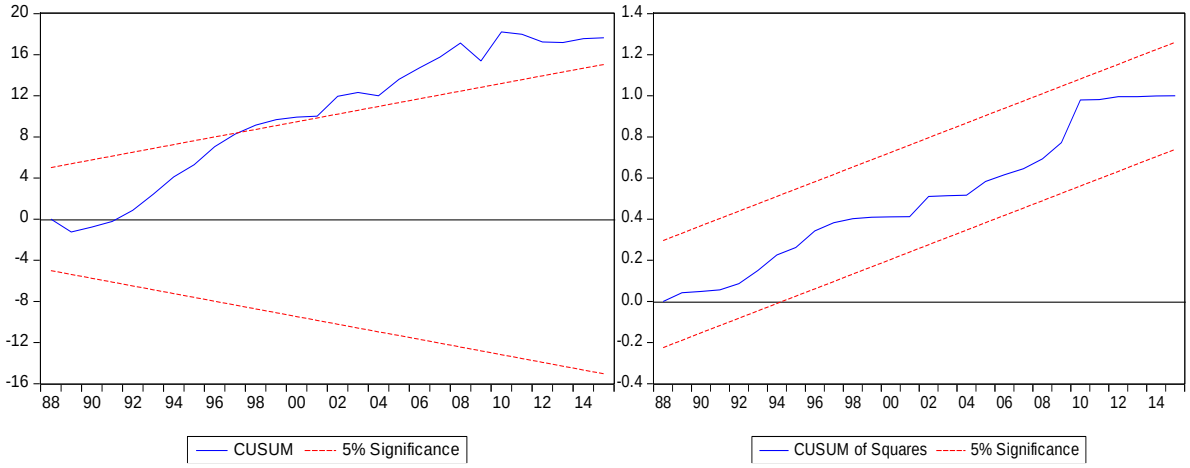
Rwanda



Tanzania



Uganda



The results of the stability of money demand function reveals divergence for the EAC member states. Specifically, the results show that the demand for money is stable in the cases of Burundi, Rwanda and Tanzania based on both CUSUM and CUSUM squared tests. While for the remaining two countries, only partial stability is apparent because one of the two tests reveals instability. In the case of Kenya, the demand for money is stable based on the CUSUM test but unstable based on the CUSUM squared test while in the case of Uganda, the results show that the demand for money is unstable in the light of the CUSUM test but stable from the perspective of the CUSUM squared test.

5. Additional analysis

In the main estimation, we employed M2 or broad money as the main measure of monetary aggregate. Our choice of M2 over M1 in the main estimation is because it reflects more of the reality in African countries given the advancement of technology. However, since M2 is M1 plus near money, and near money comprises of money market securities, mutual funds, and time deposit while M1 is currency in circulation and demand deposit, M1 is more liquid than M2. To understand how liquidity influences demand for money function, we therefore re-estimate the main equation using M1. We commenced with ARDL estimation and then ECM analysis with the corresponding results presented in Tables 7 and Table 8, respectively.

Table 7: Cointegration tests

Countries	ARDL structure	F-statistics	Remarks
Burundi	2,0,1,1,2	**6.916*** **	Cointegrated
Kenya	1,3,3,3,3	**8.345*** **	Cointegrated
Rwanda	1,3,0,1,0	**7.656****	Cointegrated
Tanzania	2,0,0,1,3	**6.198*** **	Cointegrated
Uganda	1,0,0,0,0	2.289	No-Cointegrated

Notes: *, **, *** are significance levels of 10%, 5% and 1% respectively.
ARDL: Autoregressive Distributed Lag.

Table 8: Long-run and short-term effects

	Burundi	Kenya	Rwanda	Tanzania	Uganda	ALL
Long-run estimation						
Constant	15.853	-42.523	**8.410*** **	**-21.407** **		**3.232*** **
	(7.511)	(11.726)	**(1.493)**	**(9.137)**		**(0.311)**
LRGDP	0.175	**2.758*** **	**0.524*** **	**1.699*** **		**0.477*** **
	(0.347)	**(0.502)**	**(0.062)**	**(0.317)**		**(0.105)**
INFL	**-0.024** **	**-0.022** **	**-0.006***	-0.0134		**0.005** **
	(0.009)	**(0.008)**	**(0.003)**	(0.017)		**(0.002)**
LEXCH	**0.301** **	-0.243	**0.134** **	0.114		-0.011
	(0.141)	(0.141)	**(0.065)**	(0.172)		(0.030)
UKINTEREST	0.006	**0.085***	-0.010	0.104		**-0.020***
	(0.026)	**(0.042)**	(0.011)	(0.072)		**(0.011)**
Short-run estimation						
ΔLRM1(-1)	**-0.409** **			**0.292** **		
	(0.171)			**(0.122)**		
ΔLRGDP	0.071	0.163	**0.222*** **	**0.520** **	-2.035	**0.556***
	(0.158)	(0.637)	**(0.062)**	**(0.227)**	(1.631)	**(0.298)**
ΔLRGDP(-1)		**2.563***	**-0.371*** **			
		(1.442)	**(0.70)**			
ΔLRGDP(-2)		**-3.016** **	**-0.226** **			
		(1.193)	**(0.084)**			
ΔINFL	**-0.004** **	-0.002	**-0.003** **	-0.004	-0.001	**-0.001** **
	(0.002)	(0.003)	**(0.002)**	(0.003)	(0.001)	**(0.001)**
ΔINFL(-1)		**0.006** **				
		(0.002)				
ΔINFL(-2)		**0.006***				
		(0.003)				
ΔLEXCH	**-0.492** **	**-0.652** **	**-0.500*** **	**0.212**	**-0.215** **	-0.126
	(0.202)	**(0.239)**	**(0.157)**	**(0.125)**	**(0.024)**	(0.091)
ΔLEXCH(-1)		-0.061				
		(0.139)				
ΔLEXCH(-2)		-0.226				
		(0.141)				
ΔUKINTEREST	-0.014	-0.025	-0.006	**0.013***	-0.009	**-0.021*** **
	(0.009)	(0.014)	(0.007)	**(0.007)**	(0.024)	**(0.003)**
ΔUKINTEREST(-1)	-0.015	0.026		0.019		
	(0.011)	(0.018)		(0.014)		
ΔUKINTEREST(-2)		**-0.050** **		**-0.033*** **		
		(0.019)		**(0.008)**		
ECT	**-0.408*** **	**-0.503*** **	**-0.602*** **	**-0.306***		**-0.334*** **
	(0.131)	**(0.153)**	**(0.117)**	**(0.173)**		**(0.036)**
R-squared	0.942	0.979	0.973	0.989	0.037	
Normality	0.854	0.631	0.697	0.289	0.018	
ARCH test	0.598	0.083	0.822	0.624	0.422	
BG LM test	0.404	0.140	0.036	0.198	0.121	
CUSUM	Stable	Stable	Stable	Stable	Stable	
CUSUMSQ	Stable	Not stable	Stable	Not stable	Not stable	

Notes: *, **, *** are significance levels of 10%, 5% and 1% respectively. RM1 is real narrow money; RGDP is real gross domestic product; INFL is inflation rate based on GDP deflator; EXCH is the exchange rate; UKINTEREST is the UK interest rate and ECT is the Error correct term. CUSUM: Cumulative Sum. CUSUMSQ: CUSUM of square. The reported values in parentheses are the standard errors. The reported value for Normality test, ARCH test and BG LM test are the probability values of the F-statistics. BG is Breusch-Godfrey Serial correlation LM test.

The result of the ARDL co-integration test presented in Table 7 shows that a long-run relationship holds for four countries: Burundi, Kenya, Rwanda, and Tanzania. Three out of the four countries (Burundi, Kenya and Tanzania) also exhibited a long-run relationship when M2 was used to measure monetary aggregate. Turning to Table 8, where the results of the ECM estimations are presented, and the reported findings did not deviate from what was reported in Table 6 in terms of divergence in the stability condition of demand for money in the selected countries and the response of demand for money to changes in the dependent variables.

In addition to the use of an alternative measure of monetary aggregate, we also use an alternative co-integration test approach, notably, the Gregory and Hansen co-integration test. The test was developed by Gregory and Hansen (1996). The main advantage of the approach is that it incorporates structural breaks into the modeling of the co-integration estimation. This is important because structural changes in the economy that are the sources of structural shifts might alter the results obtained.

The study findings are reported in Table 9. The result should be interpreted with caution due to the limited number of observations used in the study. A typical Gregory and Hansen co-integration test requires a large number of observations. We are however guarded by data available. There are three tests within the Gregory and Hansen co-integration framework, namely, the ADF, Z_t^*, and Z_α^* test types. The properties of each of these three tests are reported inGregory and Hansen (1996). Also, the structural change could be modelled in three ways with intercept, trend and regime shift features. From the results presented in Table 9, it is apparent that by incorporating structural breaks, we were unable to establish co-integrating relationships in most countries as observed when ARDL was used. However, the results reinforce our initial idea about the divergence in the stability condition in the selected countries within the proposed EAMU bloc.

Table 9: Gregory and Hansen (1996) co-integration test result

		M2						M1					
		ADF		Z_t^*		Z_α^*		ADF		Z_t^*		Z_α^*	
		Test statistics	Break date	Test statistics	Break date	Test statistics	Break date	Test statistics	Break date	Test statistics	Break date	Test statistics	Break date
Burundi	C	-4.28	2010	-4.38	2010	-24.79	2010	-3.87	2003	-3.93	2003	-23.64	2003
	C/T	-4.75	2010	-4.82	2010	-28.56	2010	-3.85	2003	-3.91	2002	-32.07	2002
	C/S	-5.28	2002	-5.36	2002	-31.23	2002	-5.28	2002	-5.45	2002	-32.07	2002
Kenya	C	-5.64**	2005	-5.63**	2005	-32.63	2005	-3.75	2001	-3.81	2001	-20.92	2001
	C/T	-5.83*	2001	-5.75*	2001	-32.80	2001	-5.43*	1994	-5.51*	1994	-32.01	1994
	C/S	-6.04	2002	-6.04	2002	-35.17	2002	-3.61	2001	-3.67	2001	-19.85	2001
Rwanda	C	-4.52	1985	-4.67	1985	-29.12	1985	-5.08	1992	-5.16	1992	-31.03	1992
	C/T	-5.22	1990	-4.84	1990	-29.64	1990	-5.95**	1988	-6.04**	1988	-34.24	1988
	C/S	-4.98	1989	-5.06	1989	-32.50	1989	-6.88**	1992	-6.98***	1992	-41.81	1992
Tanzania	C	-4.52	1995	-3.94	1996	-20.97	1996	-5.06	1988	-4.96	1988	-20.18	1988
	C/T	-4.79	2002	-4.51	2001	-25.65	2001	-4.71	1985	-5.06	1985	-19.66	1985
	C/S	-4.91	1999	-4.98	1996	-29.51	1996	-4.93	2006	-4.80	1994	-23.09	1994
Uganda	C	-5.38*	2008	-5.18	1987	-30.98	1987	-4.98	2008	-4.81	2007	-28.39	2007
	C/T	-4.25	2010	-4.49	2010	-26.56	2010	-6.40***	2010	-5.91**	2010	-34.98	2010
	C/S	-6.51**	2003	-4.82	1994	-29.05	1994	-6.36*	2001	-5.29	2000	-30.15	2000

		ADF			Z_t^*			Z_α^*		
		1%	5%	10%	1%	5%	10%	1%	5%	10%
Critical value	C	-6.05	-5.56	-5.31	-6.05	-5.56	-5.31	-70.18	-59.40	-54.38
	C/T	-6.36	-5.83	-5.59	-6.36	-5.83	-5.59	-76.95	-65.44	-60.12
	C/S	-6.92	-6.41	-6.17	-6.92	-6.41	-6.17	-90.35	-78.52	-75.56

Notes: *, **, *** are significance levels of 10%, 5% and 1% respectively; C is intercept, C/T is trend; C/S is regime shift; M1 is real narrow money; M2 is real broad money and ADF is Augment Dickey Fuller.

6. Concluding implications and future research directions

In order to complement the existing literature, this study has investigated the stability of money in the proposed East African Monetary Union (EAMU). The study uses annual data for the period 1981 to 2015 from five countries constituting the East African Community (EAC). A standard money demand function is designed and estimated using a bounds testing approach to co-integration and error-correction modeling. The findings show divergence across countries in the stability of money. This divergence is articulated in terms of differences in CUSUM (cumulative sum) and CUSUMSQ (CUSUM squared) tests, short-run and long term determinants and error correction in event of a shock. Specifically, the results show that the demand for money is stable in the cases of Burundi, Rwanda and Tanzania based on the CUSUM and CUSUMSQ tests, while for the remaining countries (Kenya and Uganda) only partial stability is apparent. In event of a shock, Kenya will restore its long run equilibrium fastest, followed by Tanzania and Burundi. Uganda does not have the capacity to cushion asymmetric shocks and restore long-term equilibrium while such a possibility of restoration is not applicable to Rwanda because of the absence of a cointegration relationship. Contingent on this capacity to cushion asymmetric shocks, Rwanda and Uganda may be excluded from the proposed union. This is essentially because there is evidence of a panel-based error correction mechanism which is fundamentally driven by three countries. In what follows, we discuss policy implications in the light of convergence needed for the feasibility of the proposed EAMU.

In the light of differences in macroeconomic fundamentals of money demand, convergence among member states can be improved by enhanced trade integration as well as reliable and accessible infrastructure. Moreover, as it is apparent with the European Monetary Union (EMU), conducive trade and institutional environments are important for enhancing trade on the one hand and the benefits of trade from the potential monetary integration on the other hand (UNCTAD, 2014; Asongu et al., 2017). Apart from these broader and common policy harmonizing recommendations, idiosyncratic or country-specific policies are also worthwhile. For instance, in the short run, whereas Kenya and Tanzania need to work towards a significant connection between inflation and money demand, Uganda and Burundi are not associated with the underlying short run policy concern. This is essentially because for monetary policy to be harmonized across countries, it is relevant for inflation to significantly affect money demand in all member states.

The timing of the effects of money demand determinants is also important in policy harmonization because the alignment of non-contemporary determinants is crucial in monetary policy effectiveness. In essence, as we have established, the determinants of money demand are contingent on the lag structure of corresponding determinants. For instance, in the short-run, the effect of income on money demand is contemporary in Rwanda and non-contemporary in Kenya and Tanzania. The non-contemporary effect is also contingent because it is associated with two lags for Kenya and one lag for Tanzania.

A relevant outcome of the quantity theory of money is that, changes in output and prices that affect variations in money supply are more feasible when the velocity of money is stable. An important lesson from the recent EMU crisis to proposed African monetary unions is the importance of stable macroeconomic policies. Hence, countries such as Kenya and Uganda which are reflecting only partial stability in money demand need to devote more effort towards consolidating the stability of their money demand functions.

Other measures that would go a long way towards improving convergence include: (i) adjustment of determinants of money demand to align with country-specific monetary policies; (ii) constructing good institutions that can enforce fiscal discipline and enable macroeconomic surveillance; (iii) building robust institutional networks that can consolidate financial, monetary and fiscal stability; (iv) introducing a common basket currency alongside member states currencies as an alternative to fast-tracking the single currency process and (v) implementing structural reforms which address needs in policy and infrastructure. These recommendations are informed by fact that, the lack of convergence can be traceable to high economic performance and absence of "political will" by member states to sustain the commitment to the common currency (see Kuteesa, 2012). Therefore, revisiting some of the proposed benchmarks to monetary convergence is worthwhile.

Divergence could also result from information asymmetry on proposed benchmarks and objectives of convergence in the demand for money. Such information asymmetry can be reduced by sharing relevant information which can be facilitated by data collection facilities, harmonizing statistics, improving competences and skills, and bridging technology gaps. Future research can focus on assessing how reducing such information asymmetry improves the feasibility of the proposed EAMU.

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