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Abstract

This study examines the stability of money demand in the proposed West African Monetary Union (WAMU). The study uses annual data for the period 1981 to 2015 from thirteen of the fifteen countries making-up the Economic Community of West African States (ECOWAS). 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 ECOWAS member states in the stability of money demand. This divergence is informed by differences in cointegration, stability, short run and long term determinants, and error correction in event of a shock.

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

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1. Introduction

This study investigates if the demand for money is stable in the long run in the potential West African Monetary Union (WAMU). Three main tendencies in policy and scholarly circles motivate the positioning of the study, namely: (i) the policy importance of establishing whether the demand for money in the proposed WAMU is stable in the long run or not; (ii) current debates in the extant literature on the connection between the stability of money demand and monetary policy effectiveness and (iii) gaps in the literature. In what follows, these motivational elements are expanded in the same order of chronology.

First, as concerns the relevance of the inquiry to policy, the recent experience of the European Monetary Union (EMU) in terms of currency crisis has shown that protocols in monetary negotiations should be carefully designed to be robust to a variety of macroeconomic uncertainties because associated asymmetric shocks are not without substantial detrimental development externalities (Asongu, 2013a). Against this backdrop, a comprehensive understanding of the robustness of monetary policy in a potential monetary union (such as the proposed WAMU) is essential in the process of economic integration towards a common currency area.

Second, the importance of interest rate as an instrument of monetary policy (in the light of the stability of the demand for money) has not reached a clear consensus in the literature (Asongu, 2016). A strand of the literature posits that if the demand for money is stable, mainstream monetary policy instruments can be employed to influence the supply of money (Poole, 1970). In essence, as documented in Folarin and Asongu (2017), this strand maintains that the interest rate is conducive as an effective monetary policy instrument if and only if the demand for money is characterised by significant stability.

A contending strand however maintains that the use of interest rates by central banks in influencing monetary policy is inappropriate in developing nations, essentially because the demand for money is stable (Rao & Kumar, 2009). In relation to this strand, since predicting the money function is difficult, the interest rate can be adjusted to an unstable demand for money function. In essence, drivers of money supply (e.g. scale and opportunity variables), could fall short of being associated with much information about the demand for money. This is partly because information on the opportunity cost or the forgone alternative of keeping money is reflected in opportunity variables. The interest rate is a natural example of an opportunity variable. Hence, the demand for money can be defined in terms of some unpredictability, essentially because changes in interest rates are exogenous to the demand function of money. It is principally on the grounds that the demand for money cannot easily

be predicted that interest rates can be used as an instrument of monetary policy (Folarin & Asongu, 2017).

There is another contending strand in the literature which is of the position that monetary policy is technically not feasible in less developed countries because of structural deficiencies. Weeks (2010) within this framework acknowledges that the fundamental approach of monetary policy is unfeasible in most African countries because governments lack the relevant instruments with which to implement corresponding monetary policy. These deficiencies in appropriate mechanisms are situated along: (i) the role of private credit by means of channels such as open market operations and (ii) efforts towards influencing borrowing rates within the private sector via changes in interest rates at which commercial banks can borrow from a central bank.

It is important to note that the underlying inappropriateness of monetary policy is consistent with traditional discretionary monetary policy arrangements that are focused on ensuring economic growth and price stability. Such fundamental discretionary policies are founded on the premise of either using monetary policy in a contractionary sense (i.e. when economic output exceeds its potential) or from an expansionary perspective (i.e. when economic output is below its potential). This discourse is in accordance with the literature on instrumenting inflation targeting in order to implement monetary policy that is countercyclical (Ghironi & Rebucci, 2000; Mishkin, 2002; Cavoli & Rajan, 2008; Cristadoro & Veronese, 2011; Levine, 2012; Asongu, 2014a).

Third, as recently argued by Folarin and Asongu (2017), the extant contemporary empirical literature on the stability of money demand in developing countries is fundamentally motivated by the role financial innovation has played in enhancing the instability of money demand. Some recent literature that is consistent with this argument include: Ndirangu and Nyamongo (2015), Kumar (2011) and Nachega *et al.* (2001) for Uganda, twenty developing countries and Kenya, respectively. Within the specific context of this study which focuses on the WAMU, the extant literature pertaining to this potential monetary zone has fundamentally focused on investigating if the potential currency area is feasible or unfeasible. Most accounts in the corresponding literature maintain that while it may be feasible in the long run, conditions (of convergence in and synchronisation of macroeconomic variables) do not warrant a short run thesis on feasibility. As summarised in Section 2, conclusions have been situated along the proposed WAMU's feasibility (Diop, 2012; Ogunkola, 2005); unfeasibility (Houssa, 2008; Debrun *et al.*, 2005; Chuku, 2012; Alagidede *et al.*, 2012; Tsangarides & Qureshi, 2006; Cham, 2009; Harvey & Cushing, 2015;

Asongu, 2013b, 2014b, 2014c; Dufrénot & Sugimoto, 2013; Diop et al., 2018) and conditional feasibility (Ekpoh & Udoh, 2013; Saka *et al*., 2015; Asongu, 2014a; Bénassy-Quéré & Coupet, 2005; Bangaké, 2008)[2].

This study is an extension of the underlying literature (highlighted in the third strand) in order to contribute to the extant debate on the effectiveness of monetary policy (articulated in the second strand), with the ultimate goal of improving policy insights into the feasibility of the potential WAMU (discussed in the first strand). The suggested extension is achieved by employing an autoregressive distributed lag (ARDL) bounds testing empirical strategy to cointegration developed by Pesaran *et al.* (2001). The strategy enables an error correction modelling approach to assess long and short term relationships between money supply and its determinants. The findings show divergence across ECOWAS member states in the stability of money. This divergence is informed by differences in cointegration, structural breaks, short run and long term determinants and error correction in event of a shock.

The remainder of the paper is organised as follows. Sections 2 briefly summarises the extant literature while issues pertaining to the data and methodology are covered in Section 3. Section 4 presents and discusses the empirical results while Section 5 concludes with future research directions.

2. Literature review

Before summarizing the extant literature, it is worthwhile to briefly engage the historical context of the proposed WAMU. In accordance with Asongu *et al.* (2017), a prior exposition on the historical context of the African Union (AU) sets the groundwork for the proposed regional monetary union. According to the narrative, the AU has as a fundamental objective, the creation of the African Economic Community. This objective which was framed in the June 1991 Abuja treaty estimates the establishment of an African Central Bank by 2018. Moreover, a harmonized economic community is set to precede the creation of this bank. Ultimately, the African Monetary Union (AMU) is contextualized with an Economic and Monetary Union (EMU) that is managed by an African Central Bank for the interest of AU member states. Most importantly, an AMU is a step-wise process that entails the integration of proposed regional monetary unions, among others; the Southern African Monetary Union,

[2] The positioning of the study is also partly motivated by a contemporary strand of literature on the relevance of financial access and alternative modes of financing in Africa's development (Triki & Gajigo, 2014; Amponsah, 2017; Danquah *et al*., 2017; Kusi *et al*., 2017; Boamah, 2017; Bayraktar & Fofack, 2018; Tchamyou, 2018a, 2018b; Boateng *et al*., 2018; Asongu *et al*., 2018a, 2018b; Kusi & Opoku- Mensah, 2018; Gyeke-Dako *et al*., 2018; Bokpin et al., 2018).

the East African Monetary Union and the WAMU. The extant literature pertaining to the WAMU is summarized in what follows.

The fundamentals of a common monetary system in the Economic Community of West African States (ECOWAS) which, were established in May 1975 are broadly in line with the objectives articulated in the Treaty of Lagos in 1975. This is a treaty that laid the foundation of ECOWAS by emphasizing the imperative of harmonizing economic and monetary policies across member states (Harvey & Cushing, 2015). The underlying treaty was later ratified by fifteen countries making-up the ECOWAS body, namely: Benin, Burkina Faso, Côte d'Ivoire, Ghana, Guinea, Guinea-Bissau, Liberia, Mali, Mauritania, Niger, Nigeria, Senegal, Sierra Leone, the Gambia and Togo. It is also important to note that while Cape Verde (or Cabo Verde) joined in 1976, Mauritania left in 2000.

Against the above backdrop, the ECOWAS consists if English-, French- and Portuguese-speaking nations. Furthermore, when the regional body was established, a common currency was already being used between countries in the French-speaking community of the region, namely: the West African Economic and Monetary Union (WAEMU). In other words, the currency is for the most part used by the former French Colonies of Africa (CFA) in the West African block. This is contrary to the English-speaking former colonies that preferred monetary experience and independence in the post-colonial period.

The idea of using a single currency across the region (i.e. proposed WAMU) was reiterated and further articulated in July 1991 by member states. Under the auspices of the new umbrella, a process of monetary integration was proposed to be adopted in two stages. The first consisted of establishing a common currency in the non-CFA countries. This was to be known as the West African Monetary Zone (WAMZ). The second phase consisted of merging the WAMZ with the WAEMU.

Later in the year 2000, a common ambition was expressed by member states of the ECOWAS to accelerate the process of monetary integration, notably: with the ambition of establishing the WAMZ in January 2015 and merging the WAEMU with the WAMZ by 2020. With the first and second stages expected to be realised in 2015 and 2020 respectively, in July 2014, the ambition of materialising the first page was postponed. This postponement is the fourth, given the three initial postponements in 2003, 2005 and 2009. The main justification put forward for the underlying postponement has centred on the absence of convergence among member states and insufficient preparation by member states. The two-phase initiative for monetary integration was changed to a single currency strategy in July

2014 with emphasis on: (i) the abandonment of the first stage in 2015 and (ii) a desire for the creation of the single regional currency by 2020.

Table 1: Summary of empirical studies on the proposed West African Monetary Union (WAMU)

Author(s)	Period	Countries	Methodology	Feasibility	Justification/ recommendation
Ogunkola (2005)	1970-1997	ECOWAS	A RER variability model	Yes	Growing RER convergence
Debrun*et al.* (2005)	1996-2000	ECOWAS	A calibration model	No	Presence of fiscal heterogeneity
Bénassy-Quéré & Coupet (2005)	1986-1999	17 Sub-Saharan African countries(CAEMC, WAEMU, WAMZ and ECOWAS)	Clustering analysis	Yes/No	Yes with Gambia, Ghana and Sierra Leone
Diop (2012)	1997-2004	ECOWAS	Gravity model	Yes	Substantial gains in trade
Tsangarides & Qureshi (2008)	1990-2004	ECOWAS	Clustering analysis	No	Dissimilar economic characteristics between WAMZ and WAEMU
Bangaké (2008)	1990-2003	21 African countries	system of simultaneous equations and GMM	Yes/No	Yes with Ghana, No with Nigeria
Houssa (2008)	1966-2000	ECOWAS	VAR	No	Asymmetry of supply shocks
Masson (2008)	1995-2000	ECOWAS	Welfare gain analysis	Yes/No	Selective expansion
Cham (2009).	1980-2005	ECOWAS	Exploratory convergence criteria	No	Significant absence of convergence
Alagidede *et al*. (2012)	1961-2010	Gambia, Ghana, Guinea Bissau, Nigeria and Sierra Leone	Fractional integration and cointegration	No	Heterogeneity in inflation and economic trends
Chuku (2012)	1970-2010	ECOWAS	Symmetry and/or asymmetry of responses to macroeconomic shocks.	No	Costs (asymmetry) outweigh benefits (symmetry of shock).
Ekpoh & Udoh (2013)	2005-2010	ECOWAS	Exploratory convergence criteria.	Yes/No	Yes, but at the price of monetary policy.ineffectiveness is boosting output.
Coulibaly & Gnimassoun (2013)	1985-2009	ECOWAS	Convergence and co-movements between exchange rate misalignments.	Yes/No	The WAEMU could be joined by Ghana and Gambia.
Dufrénot & Sugimoto (2013)	1999-2008	ECOWAS	Counterfactual analyses and simulations.	No	Simulations show little support for a dominant peg.
Asongu (2013b)	1980-2010	Gambia, Ghana, Nigeria, Sierra Leone	Granger causality	No	Non-traditional monetary policy instruments.
Asongu (2014a)	1980-2009	The Gambia, Ghana, Nigeria and Sierra Leone	Cointergration and VECM	Yes/No	Evidence of cointegration but with dissimilar nexus of fundamental with the equilibrium.
Asongu (2014b)	1981-2009	Gambia, Ghana, Nigeria, Sierra Leone	GMM	No	Lack of real, monetary and fiscal policy convergence.
Asongu (2014c)	1980-2010	Gambia, Ghana, Nigeria, Sierra Leone	VAR	No	Ineffective monetary policies.
Saka *et al*. (2015)	2000-2008	ECOWAS	Panel least squares and beta convergence.	Yes/No	Evidence of income convergence but more integration is needed.
Harvey & Cushing (2015)	1987-2011	Gambia, Ghana, Guinea, Nigeria, Sierra Leone	Structural VAR, impulse-response and variance decomposition.	No	Uncommon sources of shocks and asymmetric responses to common shocks.

ECOWAS: Economic Community of West African States. RER: Real Exchange Rate. CAEMC: Central African Economic and Monetary Community. WAEMU: West African Economic and Monetary Union. GMM: Generalised Method of Moments. VECM: Vector Error Correction Model. VAR: Vector autoregression.
Source: Asongu *et al*. (2017).

The extant literature on the feasibility of the potential monetary zone is mixed at best, notably, with results standing for feasibility (Diop, 2012; Ogunkola, 2005), unfeasibility (Debrun *et al*., 2005; Houssa, 2008; Tsangarides & Qureshi, 2006; Cham, 2009; Chuku, 2012; Alagidede *et al*., 2012; Dufrénot & Sugimoto, 2013; Asongu, 2013b, 2014b,2014c ; Harvey & Cushing, 2015) and contingent feasibility (Bénassy-Quéré & Coupet, 2005; Saka *et al*., 2015; Bangaké, 2008; Asongu, 2014a; Ekpoh & Udoh, 2013)[3]. It is important to note that the mainstream narrative is that the proposed currency in West Africa, while not feasible in the short run, could be viable in the long-term, contingent on convergence in some fundamental macroeconomic policies. However, it is also relevant to emphasise that there are studies which could question this assertion. For instance, Zhao and Kim (2009) reveal findings showing that the CFA Franc zone is not an Optimum Currency Union owing to asymmetric responses to shocks. Miles (2017) also shows that there is business cycle divergence exhibited by countries in the potential WAMU. According to the author, strong variations in the structure of the potential member states, rather than just varying policies, inhibit the feasibility of the monetary union.

A recurrent stance in the extant studies is the need for a selective process of integration such that some common clusters are identified and integrated first whereas others are disqualified as candidates (at the initial phase) on the grounds of fundamental asymmetries in underpinning convergence policies. This selective positioning is consistent with, *inter alia*: (i) the readiness of Ghana and the Gambia to integrate the WAEMU (Coulibaly & Gnimassoun, 2013) and (ii) the disqualification of Nigeria as a member state of the WAMEU (Bénassy-Quéré & Coupet, 2005; Debrun*et al*., 2005; Bangaké, 2008; Masson, 2006, 2008). For lack of space and imperative of avoiding repetition, the highlighted literature which is synthesized in Table 1 is substantiated in a survey by Asongu *et al*. (2017).

3. Data and Methodology

3.1 Data

The study is based on annual data for the period 1981 to 2015 from thirteen of the fifteen ECOWAS member states, namely: Benin, Burkina Faso, Cape Verde, Côte d'Ivoire, the Gambia, Ghana, Liberia, Mali, Niger, Nigeria, Senegal, Sierra Leone and Togo. The choice

[3] Moreover, the bulk of contemporary financial development literature on Africa has not focused on the feasibility of proposed continental monetary unions (Daniel, 2017; Wale & Makina, 2017; Chikalipah, 2017; Osah & Kyobe, 2017; Bocher *et al*., 2017; Oben & Sakyi, 2017; Boadi *et al*., 2017; Ofori-Sasu *et al*., 2017; Chapoto & Aboagye, 2017; Iyke & Odhiambo, 2017).

of annual data is because of data availability constraints for all sampled countries. Guinea and Guinea-Bissau are omitted because of data limitation. The earliest money demand data for Guinea is in 1991 while that of Guinea-Bissau is in 1986. The data is from World Development Indicators (WDI) and the International Financial Statistics. The adopted variables which are in accordance with the literature discussed in the introduction have been recently used by Folarin and Asongu (2017). They include: the rate of inflation, foreign exchange rate, real effective exchange rate, real gross domestic product and real broad money. The definitions of these variables and related sources (which are disclosed in Table 2) are substantiated in what follows.

(i)Real gross domestic product (GDP) is GDP divided by the GDP deflator. It reflects the monetary value (evaluated at constant price) related to goods and services that are produced within an economy over a specified time interval. (ii) Real broad money represents nominal broad money which is divided by the GDP deflator. It articulates narrow money plus time and saving deposits (at constant price) with commercial banks. Moreover, real GDP and broad money are obtained by dividing GDP and broad money respectively by the consumer price index. (iii) The rate of inflation is the GDP deflator and can also be defined as the percentage variation in the GDP deflator. (iv) The exchange rate is the official exchange rate in local currency units relative to the United States Dollar. (v) Foreign interest rate denotes US three month treasury bills, which are short run interest variations on government security. Whereas the first-four variables are from World Development Indicators, the fifth is from the International Financial Statistics.

The summary statistics is disclosed in Table 3. It is apparent from the table that there is some considerable degree of variation in the variables being investigated. Hence, we can be confident the reasonable estimated nexuses would emerge for the empirical investigation of the stability of the demand for money in the proposed WAMU.

Table 2: Definitions and sources of variables

Variables	Full names	Definitions	Sources
RM2	Real broad money	Nominal board money divided by GDP deflator	World Development Indicators (WDI)
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)
USINTEREST	Foreign interest rate	USThree month treasury bill rate	International Financial statistics (IFS)

Note: 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. USINTEREST; Foreign interest rate.

Table 3: Descriptive Statistics for the Economic Community of West African States (ECOWAS)

		RM2'Billion	RGDP' Billion	INFL	EXCH	USINTEREST
Benin	Mean	6.06	21.3	4.35	467.07	4.48
	Maximum	16.9	39.4	35.03	733.04	14.35
	Minimum	2.35	10.7	-4.88	264.69	0.03
	Standard deviation	3.99	8.75	6.77	132.25	3.51
Burkina Faso	Mean	5.02	20.5	3.22	467.07	4.48
	Maximum	16.6	43.7	14.64	733.04	14.35
	Minimum	1.10	8.31	-6.35	264.69	0.03
	Standard deviation	4.09	11.0	4.31	132.25	3.51
Cabo Verde	Mean	0.51	0.69	3.69	84.47	4.48
	Maximum	1.41	1.40	49.35	123.23	14.35
	Minimum	0.06	0.16	-29.17	48.69	0.03
	Standard deviation	0.44	0.46	11.11	15.64	3.51
Cote d'Ivoire	Mean	27.5	99.9	4.60	467.07	4.48
	Maximum	58.5	160	46.39	733.04	14.35
	Minimum	18.5	75.4	-4.52	264.69	0.03
	Standard deviation	9.46	20.1	8.53	132.25	3.51
Gambia	Mean	0.05	0.15	11.75	16.90	4.48
	Maximum	0.13	0.24	134.04	48.44	14.35
	Minimum	0.01	0.08	-5.97	1.99	0.03
	Standard deviation	0.04	0.05	23.29	12.35	3.51
Ghana	Mean	0.04	0.15	30.17	0.61	4.48
	Maximum	0.12	0.35	123.06	2.31	14.35
	Minimum	<0.01	0.06	11.15	<0.01	0.03
	Standard deviation	0.03	0.08	22.45	0.70	3.51
Liberia	Mean	<0.01	<0.01	4.25	53.65	4.48
	Maximum	<0.01	0.01	3.99	46.44	14.35
	Minimum	<0.01	<0.01	-10.01	86.19	0.03

	Standard deviation	<0.01	<0.01	7.13	5.48	3.51
Mali	Mean	5.25	23.1	5.04	467.07	4.48
	Maximum	12.2	44.2	39.56	733.04	14.35
	Minimum	1.72	10.4	-7.59	264.69	0.03
	Standard deviation	3.01	10.4	8.32	132.25	3.51
Niger	Mean	2.75	16.6	3.60	467.07	4.48
	Maximum	8.16	31.0	32.71	733.04	14.35
	Minimum	0.99	10.2	-5.90	264.69	0.03
	Standard deviation	1.80	5.70	6.64	132.25	3.51
Nigeria	Mean	75.4	316	22.45	71.41	4.48
	Maximum	223	698	113.08	192.44	14.35
	Minimum	28.0	152	-5.67	0.62	0.03
	Standard deviation	46.2	173	27.73	66.19	3.51
Senegal	Mean	9.69	33.7	3.74	467.07	4.48
	Maximum	27.5	59.6	33.89	733.04	14.35
	Minimum	4.84	19.6	-2.45	264.69	0.03
	Standard deviation	6.04	11.9	6.38	132.25	3.51
Sierra Leone	Mean	9.69	53.0	34.07	1751.98	4.48
	Maximum	21.5	107	165.68	5080.75	14.35
	Minimum	3.68	34.5	-3.94	1.16	0.03
	Standard deviation	4.86	18.4	37.62	1647.38	3.51
Togo	Mean	3.21	8.94	4.72	467.07	4.48
	Maximum	7.75	14.6	35.84	733.04	14.35
	Minimum	1.91	5.89	-9.82	264.69	0.03
	Standard deviation	1.52	2.35	7.57	132.25	3.51

Notes: RM2 is real board money; RGDP is real gross domestic product; INFL is inflation rate based on GDP deflator; EXCH is exchange rate; USINTEREST; Foreign interest rate.

3.2 Methodology

Following recent literature on the stability of money demand (Folarin & Asongu, 2017), the theoretical framework underpinning an assessment of the stability of the demand for money is consistent with Hossain (1993, p. 91). For the purpose of this study, whereas real income is employed as a scale variable, opportunity variables include: the interest rate and the inflation rate. In line with Bahmani-Oskooee and Gelan (2009), the use of interest rate as an opportunity variable within the context of developing countries could be misleading because of the relative underdevelopment of the financial sector, owing partly to the substantial relevance of the informal financial sector. Accordingly, a great chunk of the monetary base in developing countries does not circulate within the formal financial sector (Tchamyou & Asongu, 2017; Tchamyou *et al.*, 2018). Bahmani-Oskooee and Gelan (2009) have further argued that such countries with a comparatively undeveloped financial sector reflect a tendency in which the interest rate does not mirror the complete marker situation. The shortcoming can be addressed by using the inflation rate. In the extant literature, we find

studies that have employed both the interest and the inflation rates (e.g. Kumar *et al.*, 2013) as well as those that have exclusively used the interest rate (Akinlo, 2006; Anoruo, 2002). We employ both the interest rate and inflation rate in this study.

The money demand literature has emphasised the importance of considering currency substitution as well as foreign interest rates in the investigation of the demand function of money (Folarin & Asongu, 2017). For example, according to Chaisrisawatsuk *et al.* (2004), with respect to the consideration of foreign bonds by citizens as an alternative mechanism of investment, the projected return on the corresponding investment should have an incidence on the demand for money. It is essential to also point out that, the effect of exchange rate on the demand for money is mirrored by currency substitution whereas the importance of foreign interest rates on the demand for money is articulated by the effect of capital mobility.

Building on the discussed empirical background, the assessment of money demand in this paper can be expressed by the following equation:

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

where M/P is real monetary aggregate, M is nominal monetary aggregate, p is price level, y is income variable, op are opportunity variables, 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 Equation (2) are in time series, it is relevant to test their corresponding stationary properties in order to avoid spurious regressions. Such stationary properties are tested with the Ng-Perron (NP) test which has been established to be comparatively more reliable and efficient (compared to Phillip-Perron and Augmented Dickey Fuller test) when the time series is of longer periodicity. Four different estimation approaches under Ng-Perron are considered, namely, MZa, MZt, MSB and MPT. In essence, the underlying tests are from Ng and Peron (2001), who propose some improvements to the Phillips (1987) test, (MZa), Phillips and Perron (1988) (MZt), Bhargava (1986)(MSB), and the Point Optimal Test by Elliot et al. (1996)(MPT).

Table 4: Ng-Perron Unit root test results

		RM2	ΔRM2	RGDP	ΔRGDP	INFL	EXCH	ΔEXCH	USINT
Benin	MZa	-5.627	-16.441a	-6.468	-16.442a	-14.928a	-6.109	-15.382a	-20.794b
	MZt	-1.515	-2.866a	-1.765	-2.861a	-2.707a	-1.745	-2.760a	-3.204b
	MSB	0.269	0.174b	0.273	0.174b	0.181a	0.286	0.179a	0.154b
	MPT	15.807	1.494a	14.089	1.513a	1.736a	14.914	1.641a	4.506b
	Lag	0	0	0	0	0	0	0	1
Burkina Faso	MZa	-9.966	-16.016a	-3.696	-16.018a	-10.748b	-6.109	-15.382a	-20.794b
	MZt	-2.107	-2.809a	-1.330	-2.810a	-2.299b	-1.745	-2.760a	-3.204b
	MSB	0.211	0.175b	0.360	0.175b	0.214b	0.286	0.179b	0.154b
	MPT	9.682	1.608a	24.202	1.605a	2.354b	14.914	1.641a	4.506b
	Lag	0	0	0	0	0	0	0	1
Cabo Verde	MZa	-31.538a		-8.414	-11.182b	-15.431a	-4.675	-10.647b	-20.794b
	MZt	-3.947a		-1.865	-2.335b	-2.768a	-1.528	-2.273b	-3.204b
	MSB	0.125a		0.222	-0.209b	0.179a	0.328	0.213b	0.154b
	MPT	3.024a		11.395	2.306b	1.623a	19.482	2.435b	4.506b
	Lag	2		1	0	0	0	0	1
Cote d'Ivoire	MZa	-2.398	-16.003a	-25.731a		-15.793a	-6.109	-15.382a	-20.794b
	MZt	-0.777	-2.755a	-3.298b		-2.808a	-1.745	-2.760a	-3.204b
	MSB	0.324	0.172a	0.128a		0.178b	0.286	0.179b	0.154b
	MPT	26.118	1.803a	5.171a		1.561a	14.914	1.641a	4.506b
	Lag	0	0	1		0	0	0	1
Gambia	MZa	-2.094	-16.425a	-15.369c	-16.120a	-16.865a	-9.061	-15.666a	-20.794b
	MZt	-0.990	-2.864a	-2.772c	-2.814a	-2.904a	-2.123	-2.796a	-3.204b
	MSB	0.473	0.174b	0.180c	0.175b	0.172a	0.234	0.178b	0.154b
	MPT	41.623	1.497a	5.932c	1.613a	1.453a	10.076	1.576a	4.506b
	Lag	0	0	0	0	0	1	1	1
Ghana	MZa	-9.647	-16.379a	-3.257	-4.821	14.001a	-4.829	-11.754b	-20.794b
	MZt	-2.177	-2.860a	-1.062	-1.525	-2.598b	-1.404	-2.421b	-3.204b
	MSB	0.226	0.175b	0.326	0.316	0.186b	0.291	0.206b	0.154b
	MPT	9.526	1.503a	23.712	5.142	1.930b	17.995	2.097b	4.506b
	Lag	0	0	1	0	0	1	0	1
Liberia	MZa	-16.910c	-22.849a	-8.213	-11.290b	-15.308a	-16.103a		-20.794b
	MZt	-2.886c	-3.379a	-1.981	-2.376b	-2.763a	-2.773a		-3.204b
	MSB	0.171c	0.148a	0.241	0.210b	0.181b	0.172a		0.154b
	MPT	5.521c	1.076a	11.228	2.171b	1.613a	1.758a		4.506b
	Lag	0	1	1	0	0	0	0	1
Mali	MZa	-11.872	-16.374a	-6.532	-14.756a	-15.966a	-6.109	-15.382a	-20.794b
	MZt	-2.423	-2.857a	-1.801	-2.679a	-2.815a	-1.745	-2.760a	-3.204b
	MSB	0.204	0.174b	0.276	0.182b	0.176b	0.286	0.179b	0.154b
	MPT	7.747	1.512a	13.952	1.799b	1.572a	14.914	1.641a	4.506b
	Lag	0	0	1	0	0	0	0	1
Niger	MZa	-1.552	-6.472c	-2.164	-14.924a	-15.778a	-6.109	-15.382a	-20.794b
	MZt	-0.654	-1.783c	-0.792	-2.730a	-2.779a	-1.745	-2.760a	-3.204b
	MSB	0.422	0.275c	0.366	0.183a	0.176b	0.286	0.179a	0.154b
	MPT	38.750	3.839c	30.333	1.650a	1.664a	14.914	1.641a	4.506b
	Lag	0	1	0	1	0	0	0	1
Nigeria	MZa	-5.286	-16.254a	-1.588	-14.850a	-16.998a	-2.489	-16.234a	-20.794b
	MZt	-1.612	-2.850a	-0.777	-2.725a	-2.899a	-0.937	-2.848a	-3.204b
	MSB	0.305	0.175a	0.489	0.183b	0.171a	0.376	0.175a	0.154b
	MPT	17.187	1.511a	46.982	1.651a	1.499a	29.967	1.514a	4.506b
	Lag	0	0	0	0	0	0	0	1
Senegal	MZa	-1.008	-15.197a	-3.045	-15.626a	-15.071a	-6.109	-15.382a	-20.794b
	MZt	-0.432	-2.688a	-1.084	-2.786a	-2.710a	-1.745	-2.760a	-3.204b
	MSB	0.428	0.177a	0.356	0.178a	0.180a	0.286	0.179b	0.154b

	MPT	42.290	1.868b	26.315	1.602a	1.757a	14.914	1.641a	4.506b
	Lag	0	0	0	1	0	0	0	1
	MZa	-1.563	-15.062a	-2.065	-16.191a	-10.909b	-3.829	-10.469b	-20.794b
Sierra	MZt	-0.736	-2.709a	-0.936	-2.522b	-2.335b	-1.241	-2.286b	-3.204b
Leone	MSB	0.471	0.180b	0.453	0.156a	0.214b	0.324	0.218b	0.154b
	MPT	44.749	1.759a	39.580	2.645b	2.249b	21.906	2.349b	4.506b
	Lag	0	0	0	0	0	1	0	1
	MZa	-2.692	-16.408a	-7.560	-15.504a	-16.775a	-6.109	-15.382a	-20.794b
Togo	MZt	-0.934	-2.837a	-1.794	-2.754a	-2.886a	-1.745	-2.760a	-3.204b
	MSB	0.347	0.173a	0.237	0.178b	0.172a	0.286	0.179b	0.154b
	MPT	26.890	1.593a	12.355	1.693a	1.496a	14.914	1.641a	4.506b
	Lag	6	0	0	0	0	0	0	1

Note: a, b, c implies statistical significance at 1%, 5% and 10%, respectively. The variables were estimated using constant and trend for level equation except for inflation rate. This is because the inflation rate does not exhibit a trending pattern unlike for other variables. Moreover, applying first difference removes a trend thus making constant (intercept) the appropriate approach for inflation.RM2 is real board money; RGDP is real gross domestic product; INFL is inflation rate based on GDP deflator; EXCH is exchange rate; USINTEREST is foreign interest rate. The reported values are the corresponding t-statistics. Automatic lag length selection based on Schwarz Information Criterion (SIC) was employed and the resulting optimal lag length is used and reported.

In the light of the unit root test findings provided in Table 4, the variables used in the study comprises of those that are stationary in level and first difference. Inflation rate is stationary in level for all the countries while money demand, real income and exchange rate are stationary in difference for majority of the countries. A direct implication is that the ARDL empirical strategy is more appropriate. The corresponding ARDL bounds test framework from Pesaran *et al.* (2001) is employed to assess if variables have a long term nexus or are cointegrated. An appealing feature of this technique over alternative approaches (e.g. Engle & Granger and Johansen tests) is that the adopted variables must not exclusively display the same order of integration. The corresponding ARDL model is specified in Equation (3) as follows:

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

The expanded ARDL approach in Equation (3) is estimated by performing the Bounds test. Optimal lag selection for each variable is based on the Schwarz information criterion (SIC). By means of the Wald restriction, the F-statistics is then estimated, notably: by assigning restrictions to the lagged value of all level series corresponding to the two equations (see Pesaran *et al.*, 2001). The related F-statistics is later employed to examine the long run relationship among adopted variables. It is important to note that the null hypothesis

corresponding to the Wald restriction which is imposed on Equation (3) is the following: $\delta_2 = \delta_3 = \delta_4 = \delta_4 = \delta_5 = \delta_6 = 0$.

The value of the F-statistics is derived by comparing the critical values of the upper limit vis-à-vis those of the lower limit. The critical values are from Pesaran *et al*. (2001). As far as cointegration is concerned, in a situation where the estimated F-statistics surpasses the critical value corresponding to the upper limit, then the null hypothesis for the position of "no cointegration" is rejected and evidence of cointegration or a long run nexus is established. On the contrary, in a scenario where the F-statistics is situated below the lower critical value, the corresponding hypothesis of cointegration is rejected. Unfortunately, evidence of the absence or presence of cointegration cannot be established with certainty if the F-statistics falls between the critical values in the lower limit and upper limit. The results that are disclosed in Table 5 show that cointegration is apparent.

Table 5: Results of the ARDL Co-integration tests

Countries	ARDL structure	F-statistics	Remarks
Benin	1,0,0,1,1	3.079	Not cointegrated
Burkina Faso	1,0,0,0,1	2.780	Not cointegrated
Cabo Verde	2,1,0,1,0	**6.426*****	Cointegrated
Cote d'Ivoire	1,0,0,0,0	1.249	Not cointegrated
Gambia	2,0,1,0,3	**6.185*****	Cointegrated
Ghana	3,0,3,3,1	**10.358*****	Cointegrated
Liberia	2,3,3,3,3	**6.909*****	Cointegrated
Mali	1,3,0,0,1	**3.539***	Cointegrated
Niger	1,0,0,0,3	1.739	Not cointegrated
Nigeria	2,3,1,2,1	**4.151****	Cointegrated
Senegal	3,0,1,0,2	**4.294****	Cointegrated
Sierra Leone	1,0,0,0,3	1.370	Not cointegrated
Togo	1,3,0,0,0	1.211	Not cointegrated

Notes: *, **, *** are significance levels of 10%, 5% and 1% respectively.
ARDL: Autoregressive Distributed Lag. Critical values are the following:
(i) 2.45 for I0 Bound and 3.52 for the I1 Bound at the 10% significance level;
(ii) 2.86 for I0 Bound and 4.01 for the I1 Bound for the 5% significance level;
(iii) 3.25 for I0 Bound and 4.49 for the I1 Bound for the 2.5% significance level and (iv) 3.74 for I0 Bound and 5.06 for the I1 Bound for the 1% significance level.

In Table 5, the results of the cointegration are presented. From the results, evidence of cointegration is obvious in more than half (i.e. seven) of the selected ECOWAS countries, namely: Cabo Verde, Gambia, Ghana, Liberia, Mali, Nigeria and Senegal. Since, we could not establish that co-integration holds in the remaining six member states, (i.e.Benin, Burkina

Faso, Côte d'Ivoire, Niger, Sierra Leone and Togo) we perform only short-run analysis for these member states.

Given the findings from the cointegration test, the long run and short-run effects are further investigated within an error correction model (ECM) framework. Within this empirical setting, in a scenario of short-term shock, the error correction term (ECT) is the speed of adjustment back to the long run equilibrium or cointegration relationship. Furthermore, the ECM also enables the study to examine the impacts of adopted variables in the conditioning information set on the short run and long run demand for money.

The ECM is an embodiment of two steps. The first is focused on the derivation of the ECT by means of regressing the dependent variable on the corresponding independent variables and then deducting the actual value of the outcome variable from the estimated value. This is illustrated as follows.

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

Given the trending character of adopted variables, a trend is introduced into the regression equation. The ECT obtained from Equation (4) is then fitted in Equation (2) in order to derive Equation (5) which is used to estimate the ECM. The corresponding speed of adjustment is expected to show a negative sign in order for the equilibrium nexus to be potentially restorable in case of an exogenous shock. Emphasis should be made on the fact that, the negative speed of adjustment should fall within the range of 0 and 1, with 1 corresponding to a full adjustment and 0 corresponding to absence of an adjustment, one period after an exogenous shock. On the contrary, a positive value of the adjustment coefficient reflects the absence of catch-up towards the long run cointegration after such an exogenous shock. Ultimately, this reflects a permanent move from the equilibrium nexus (Asongu, 2014e).

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

The Bai and Perron test is employed to analyse the consistency of parameters (Bai & Perron, 1998; 2003). This test provides information about the stability of the parameters used in the study. Moreover, some diagnostic tests are conducted on the findings from the ECM in order to further assess its robustness and goodness of fit. These tests include, the: Jarque-Bera test for normality, Breusch-Godfrey (BG) test for serial correlation test and Autoregressive Conditional Heteroscedasticity (ARCH) test for heteroscedasticity.

4. Empirical results

Tables 6-7 show short term and long run relationships between the broad money aggregate and its determinants for the thirteen sampled countries. While Table 6 focuses on Benin, Burkina Faso, Cabo Verde, Côte d'Ivoire, the Gambia, Ghana and Liberia, Table 7 is concerned with Mali, Niger, Nigeria, Senegal, Sierra Leone and Togo. The last column of Table 7 provides panel-based evidence for the thirteen countries. Both, the long-run and short term analyses are performed exclusively for countries in which cointegration is established whereas only short term analysis is performed for countries for which cointegration is not apparent. In a nutshell, from both short term and long run perspectives, the results provide empirical evidence on the influence of income, inflation, exchange rate and foreign interest rate on the demand for money in the ECOWAS region.

The tables reveal that factors influencing the demand for money significantly vary across member states in the ECOWAS. We start our discussion of the results with the short-run analysis. Here we find that an increase in income has a positive and significant contemporary effect on demand for money in about 70% of the selected member states, namely: Benin, Cabo Verde, Côte d'Ivoire, Liberia, Mali, Nigeria, Senegal, Sierra Leone and Togo. The coefficient of income ranges from 1.622 for Senegal to 0.341 for Liberia. In addition, the results reveal that in some member states, (i.e. Cabo Verde, Gambia, Ghana, Liberia, Mali, Nigeria, and Sierra Leone), a change in inflation rate in the short-run has a significant negative effect on money demand. Furthermore, the results suggest that a change in exchange rate has a significant and positive effect on money demand in Cabo Verde, Gambia, Ghana, and Nigeria while in Liberia and Niger, a significant negative effect is observed. The last determinant examined in the study is foreign interest rate (USINTEREST).The findings reveal that the contemporary foreign interest rate exerts a negative and significant effect on money demand in Cabo Verde, and Liberia. Also, the lag value of foreign interest rate is negatively associated with demand for money in Gambia, Liberia and Senegal, thus reflecting capital mobility in response to higher interest rate in foreign country, US.

Furthermore, from the seven member states in the ECOWAS in which we were able to establish the existence of a long-run relationship between money demand and its determinants, we find that the signs of ECT coefficients are statistically significant with the expected negative sign. Going by the values of the ECT coefficients, it can be deduced that if shocks occur in countries within the ECOWAS, Liberia will restore its long-run equilibrium

first then followed by Mali while Gambia will restore its long-run equilibrium last. In decreasing order of quick speed to restoring the long-run equilibrium, we have Liberia, Mali, Ghana, Cabo Verde, Senegal, Nigeria and the Gambia.

We now turn to the long-run results, it is apparent from the findings that the effect of income on money demand is significant with the expected sign in Cabo Verde, Ghana, Liberia, Mali, Nigeria, and Senegal. The coefficient of income is greater than one across the three countries were the impact is significant, thus suggesting that an increase in income leads to a more than proportionate increase in the demand for money in the long-run. In addition, an increase in inflation rate has a significant and negative effect on money demand in Cabo Verde, Ghana, Liberia, and Mali while the effect is established to be insignificant with the expected negative sign in Nigeria and Senegal. The implication to our findings is that a decrease in the opportunity cost of holding money increases money demand.

On the effect of exchange rate, an increase in exchange rate has a significant and positive effect on money demand in Gambia and Ghana. In addition, the findings reveal that foreign interest rate has a significant and negative effect on money demand in Cabo Verde, Ghana and Mali, the corresponding effect is positive and significant in Gambia and Senegal while insignificant in Liberia and Nigeria.

In the last column of Table 7, which is the panel evidence, the ECT is negative and significant and only income has a significant effect on money holding in the ECOWAS as a group in the short-run. However, in the long-run, the results show that income has a positive and significant effect on money demand while inflation rate, exchange rate and foreign interest rate have significant negative effects on money demand, which is consistent with the theory. Accordingly, opportunity variables are expected to have an inverse relationship with money demand.

With respect to the stability of money among ECOWAS member states, the findings in Table 8 reveal some form of heterogeneity. To be specific, the results reveal that the demand for money is stable in ten out of the thirteen selected ECOWAS member states based on the Bai and Perron test. They include: Benin, Burkina Faso, Cabo Verde, Cote d'Ivoire, Gambia, Ghana, Niger, Nigeria, Senegal and Sierra Leone. The remaining three countries exhibit instability. They are Liberia in 2012, Mali in 2002 and Togo in 1998.

Overall, in Tables 6-7, the diagnostic tests of residuals overwhelmingly confirm the presence of normally distributed errors (i.e. failure to reject the null hypothesis of Jarque-

Bera test) and absence of serial correlation (i.e. failure to reject the null hypothesis of the Breusch-Godfrey).

Table 6: ARDL Estimation

	Benin	Burkina Faso	Cabo Verde	Côte d'Ivoire	Gambia	Ghana	Liberia
Long-run estimation							
Constant			**-5.024****		7.232	**9.447*****	**12.176*****
			(2.154)		(43.123)	**(2.693)**	**(0.725)**
LRGDP			**1.217*****		-0.040	**0.468*****	**-0.205****
			(0.104)		(2.462)	**(0.135)**	**(0.079)**
INFL			**-0.009****		**-0.099****	**-0.016*****	0.007
			(0.003)		**(0.047)**	**(0.005)**	(0.004)
LEXCH			0.069		**3.661****	**0.236*****	0.252
			(0.191)		**(1.691)**	**(0.029)**	(0.216)
USINTEREST			**-0.074****		**0.678****	**-0.042****	0.034
			(0.028)		**(0.283)**	**(0.017)**	(0.023)
Short-run estimation							
ΔLRM2(-1)			**0.488*****		**-0.577*****	**-0.193***	**0.475*****
			(0.113)		**(0.195)**	**(0.100)**	**(0.135)**
ΔLRM2(-2)						**-0.390*****	
						(0.124)	
ΔLRGDP	**1.419***	0.188	**1.310*****	**0.639***	-0.180	0.007	**0.341*****
	(0.699)	(0.584)	**(0.251)**	**(0.329)**	(0.503)	(0.309)	**(0.064)**
ΔLRGDP(-1)							**0.370*****
							(0.087)
ΔLRGDP(-2)							**0.544*****
							(0.107)
ΔINFL	0.004	-0.001	**-0.004*****	-0.002	**-0.006*****	**-0.004*****	**-0.003****
	(0.003)	(0.004)	**(0.000)**	(0.002)	**(0.001)**	**(0.001)**	**(0.001)**
ΔINFL(-1)						**0.004*****	**-0.005****
						(0.001)	**(0.002)**
ΔINFL(-2)						**0.002*****	**0.004****
						(0.000)	**(0.002)**
ΔLEXCH	-0.004	-0.073	**0.322*****	0.080	**0.443****	**0.290*****	**-0.683*****
	(0.147)	(0.166)	**(0.091)**	(0.162)	**(0.161)**	**(0.078)**	**(0.021)**
ΔLEXCH(-1)						0.041	0.019
						(0.063)	(0.141)
ΔLEXCH(-2)						**0.165*****	**-0.276*****
						(0.040)	**(0.049)**
ΔUSINTEREST	0.003	0.004	**-0.024*****	0.000	-0.009	-0.018	**-0.045*****
	(0.014)	(0.012)	**(0.010)**	(0.009)	(0.013)	(0.011)	**(0.011)**
ΔUSINTEREST(-1)					0.023		-0.015
					(0.015)		(0.010)
ΔUSINTEREST(-2)					**-0.049*****		**-0.035*****
					(0.013)		**(0.009)**
ECT(-1)			**-0.349*****		**-0.105*****	**-0.604*****	**-0.958*****
			(0.063)		**(0.016)**	**(0.089)**	**(0.203)**
R-squared	0.158	0.029	0.803	0.094	0.833	0.864	0.993
Normality test	0.234	0.000	0.628	0.000	0.760	0.062	0.895
ARCH test	(1)0.809	(1)0.445	(1)0.400	(1)0.291	(1)0.360	(1)0.203	(1)0.000
	(3)0.802	(3)0.757	(3)0.485	(3)0.699	(3)0.331	(3)0.584	(3)0.008
BG LM test	(1)0.787	(1)0.397	(1)0.845	(1)0.253	(1)0.494	(1)0.002	(1)0.198
	(3)0.983	(3)0.421	(3)0.975	(3)0.532	(3)0.802	(3)0.002	(3)0.297

Notes: *,**, *** denote significant at 10%, 5% and 1% respectively. 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. RM2: Real broad money. Real GDP: Real Gross Domestic Product. INFL: Inflation rate. EXCH: Exchange rate. USINTEREST; Foreign interest rate

Table 7: ARDL Estimation (Continuation)

	Mali	Niger	Nigeria	Senegal	Sierra Leone	Togo	All
Long-run estimation							
Constant	2.836		**-13.003***	**-40.593*****			**-0.221*****
	(3.015)		**(6.958)**	**(10.043)**			**(0.049)**
LRGDP	**0.813*****		**1.439*****	**2.672*****			**1.122*****
	(0.136)		**(0.259)**	**(0.409)**			**(0.219)**
INFL	**-0.013*****		-0.002	-0.007			**-0.061*****
	(0.004)		(0.006)	(0.010)			**(0.016)**
LEXCH	0.080		-0.115	-0.216			-0.070
	(0.104)		(0.087)	(0.146)			(0.071)
USINTEREST	**-0.061*****		0.045	**0.071***			**-0.074****
	(0.019)		(0.057)	**(0.035)**			**(0.038)**
Short-run estimation							
ΔLRM2(-1)			**0.828*****	-0.176			
			(0.091)	(0.160)			
ΔLRM2(-1)				**-0.472*****			
				(0.128)			
ΔLRGDP	**0.831****	0.419	**0.568*****	**1.622*****	**0.651***	**0.675***	**0.521*****
	(0.308)	(0.531)	**(0.146)**	**(0.484)**	**(0.344)**	**(0.341)**	**(0.128)**
ΔLRGDP(-1)	-0.189		**-0.290***				
	(0.347)		**(0.148)**				
ΔLRGDP(-2)	**-0.744****		**0.606****				
	(0.357)		**(0.212)**				
ΔINFL	**-0.009*****	-0.000	**-0.006*****	0.002	**-0.002***	-0.002	0.000
	(0.002)	(0.003)	**(0.001)**	(0.001)	**(0.001)**	(0.002)	(0.001)
ΔLEXCH	0.097	**-0.396****	0.018	-0.120	-0.113	0.012	0.033
	(0.114)	**(0.178)**	(0.030)	(0.091)	(0.098)	(0.134)	(0.092)
ΔLEXCH(-1)			**0.143*****				
			(0.043)				
ΔUSINTEREST	0.009	0.018	-0.011	**0.036*****	-0.017	0.015	-0.001
	(0.013)	(0.019)	(0.008)	**(0.010)**	(0.019)	(0.015)	(0.003)
ΔUSINTEREST(-1)				**-0.023****			
				(0.008)			
ECT(-1)	**-0.696*****		**-0.274*****	**-0.293*****			**-0.083*****
	(0.127)		**(0.049)**	**(0.055)**			**(0.012)**
R-squared	0.764	0.172	0.932	0.697	0.376	0.234	
Normality test	0.598	0.964	0.000	0.940	0.832	0.475	
ARCH test	(1)0.396	(1)0.081	(1)0.779	(1)0.188	(1)0.550	(1)0.506	
	(3)0.176	(3)0.365	(3)0.897	(3)0.559	(3)0.794	(3)0.307	
BG LM test	(1)0.766	(1)0.947	(1)0.561	(1)0.684	(1)0.195	(1)0.371	
	(3)0.966	(3)0.860	(3)0.486	(3)0.152	(3)0.386	(3)0.149	

Notes: *,**, *** denote significant at 10%, 5% and 1% respectively. 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. RM2: Real broad money. Real GDP: Real Gross Domestic Product. INFL: Inflation rate. EXCH: Exchange rate. USINTEREST; Foreign interest rate

Table 8: Bai and Perron stability tests results

Country	Break test	F-statistics	Critical value**
Benin	0 vs 1	3.768	11.47
Burkina Faso	0 vs 1	3.921	11.47
Cabo Verde	0 vs 1	9.863	11.47
Cote d'Ivoire	0 vs 1	11.433	11.47
Gambia	0 vs 1	7.496	11.47
Ghana	0 vs 1	6.599	11.47
Liberia	0 vs 1 (2012)*	11.477	11.47
	1 vs 2	1.527	12.95
Mali	0 vs 1 (2002)*	15.786	11.47
	1 vs 2	4.558	12.95
Niger	0 vs 1	7.984	11.47
Nigeria	0 vs 1	5.514	11.47
Senegal	0 vs 1	3.574	11.47
Sierra Leone	0 vs 1	6.149	11.47
Togo	0 vs 1 (1998)*	19.529	11.47
	1 vs 2	5.835	12.95

*significant at the 5% level; ** Bai and Perron (2003) critical value

5. Conclusion and future research directions

This study examines the stability of money in the proposed West African Monetary Union (WAMU). The study uses annual data for the period 1981 to 2015 from thirteen of the fifteen countries making-up the Economic Community of West African States (ECOWAS). 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 ECOWAS member states in the stability of money. This divergence is informed by differences in cointegration, stability, short run and long term determinants and error correction in event of a shock. Cointegration is apparent only in half of the sampled countries, namely: Cabo Verde, the Gambia, Ghana, Liberia, Mali, Nigeria and Senegal. In event of a shock, Liberia will restore its long-run equilibrium first followed by Mali, Ghana, Cabo Verde, Senegal, Nigeria and the Gambia. The demand for money is stable in ten of the thirteen selected ECOWAS member states based on the Bai and Perron test, namely: Benin, Burkina Faso, Cabo Verde, Cote d'Ivoire, Gambia, Ghana, Niger, Nigeria, Senegal and Sierra Leone. The remaining three countries exhibit instability, namely: Liberia, Mali and Togo.

Among other factors, the established divergence could be the result of information asymmetry associated with targets and benchmarks related to the demand for money. The underlying policy syndrome of information asymmetry can be mitigated by enhancing

mechanism of information sharing, notably, by: updating and synchronising data collection facilities, improving competences and skills, harmonizing statistics and bridging technology gaps. Future research can focus on examining how reducing such information asymmetry improves the feasibility of the proposed WAMU.

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