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Is West African Monetary Zone (WAMZ) a common currency area?

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Abstract

In this paper, we test whether the West African Monetary Zone (WAMZ) is a common currency area by using a structural vector autoregressive model to study the variance decomposition, impulse responses of key economic variables and linear dependence of the underlying structural shocks of the countries in the zone. The variance decomposition shows that the zone as a whole does not have common sources of shock, which is expected because of the diverse economic structures of these countries. The correlation of the structural shocks also shows that these countries respond asymmetrically to common supply, demand and monetary shocks and will therefore respond differently to a common monetary policy. It is therefore not in the interest of the individual countries to go into a monetary union now or in the near future unless the economies of these countries converge further.

JEL classification: F33

Keywords: Monetary zone; Common currency area; West Africa

1. Introduction

The quest for monetary union within Economic Community of West African States (ECOWAS) began with the establishment of the regional body in May 1975. This quest reflects in the objectives, as stated in article 2 section 2h of the 1975 Treaty of Lagos, a treaty that establishes the community, that the community shall ensure "harmonization, required for the proper functioning of the community, of the monetary policies of the member states." This is restated in article 3 section 2e of the July 1991 treaty as "the establishment of an economic union through the adoption of common policies in the economic, financial, social and cultural sectors, and the creation of a monetary union." The 15 member states that ratified the Treaty of Lagos are Benin, Burkina Faso, Côte d'Ivoire, The Gambia, Ghana, Guinea, Guinea-Bissau, Liberia, Mali, Mauritania, Niger, Nigeria, Senegal, Sierra Leone, and Togo. Cape Verde joined the community in 1976 and Mauritania left in 2000, leaving the current membership still at 15 states. The community is made up of English, French and Portuguese speaking countries.

At the time of establishment of ECOWAS, there was one monetary zone in West Africa West Africa Economic and Monetary Union (WAEMU) which is composed of Francophone West African countries. The CFA, which is the single currency in the West Africa Economic and Monetary Union (WAEMU), circulates among the member countries. Anglophone West African countries, however, have their independent currencies. The idea of introducing a single currency for ECOWAS as a whole was re-enforced in the July 1991 Treaty ratified by all member states. It has been proposed to implement the monetary integration process in two stages by forming a second monetary zone, the West African Monetary Zone (WAMZ) for the Anglophone West Africa, which will later merge with the existing zone, the West Africa Economic and Monetary Union (WAEMU). Since the introduction of the proposed single currency is in two stages, i.e. forming a monetary union among the non-CFA countries and later merge with the CFA countries, we think that analyzing the convergence of non-CFA countries alone will draw a better picture of what is needed now by ECOWAS.

In this paper, we test whether the West African Monetary Zone (WAMZ) is a optimum currency area by using a vector autoregressive model to study the variance decomposition,

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impulse responses of key economic variables and by analyzing linear dependence of and feedback between the structural shocks recovered from a structural vector autoregressive (SVAR) model of key economic variables in the region. Countries with symmetric shocks are expected to have linearly dependent shocks and exhibit some level of feedback between these shocks. Also, if the sources of shock to the region are common, then the structure of the variance decomposition should be similar across the zone.

Apart from contributing to the academic literature on monetary integration in West Africa, the approach used in this paper adds value to the previous studies in West Africa by measuring the level of integration achieved by the participating countries in terms of their response to common shocks. The methodologies used in the previous studies do not allow for the direct measurement of supply, demand and monetary shocks to the economies of the individual countries and their response to common shocks. This will also inform policy on the adoption of the single currency, the eco, in the zone and also to have an idea of how the economies of the zone converge ex-ante or will converge ex-post after the introduction of the eco.

The question of what constitutes an optimum currency area is pioneered by Mundell (1961) who defines an optimum currency area as a domain within which exchange rates are fixed. Within this domain, a single currency can be introduced under a single central bank with the power to issue and redeem currency and conduct monetary policy. The issue of an appropriate domain is addressed by Mundell (1961) by suggesting that the domain is a region that is defined such that there is internal factor mobility and external factor immobility and "if factors are mobile across national boundaries, then a flexible exchange system becomes unnecessary and may even be positively harmful".

The work of Mundell (1961) inspired a series of papers. In particular, McKinnon (1963) describes the optimum currency area as an area within which there is a single currency and within which the same monetary and fiscal policies and flexible external exchange rates can be used to address the objectives of employment, international payments and price stability which are sometimes in conflict. McKinnon emphasizes the need for price stability within the region and the openness of the economies that should be considered optimum for a single currency. McKinnon (1963) also added the importance of factor mobility across industries to Mundell's argument for factor mobility across countries in determining an optimum currency area.

The issue of factor mobility is further examined by Kenen (1969). He asserts that "when regions are defined by their activities, not geographically or politically, perfect interregional labor mobility requires perfect occupational mobility and this can only come about when labor is homogeneous" (Kenen, 1969). Kenen (1969) also advances product diversification and fiscal integration of a region as major criteria for an optimum currency area. Kenen (1969) argues that diversity in a region's product mix may be a more relevant criterion than labor mobility and that well diversified is economy is more likely to have a well-diversified export sector, which can mitigate external shocks by positive and negative shocks canceling out without resulting to exchange rate changes in response to the shock. Fiscal integration also ensures that weaker economies within the region are supported during recovery from external shocks. Eichengreen (1991) also defines an optimum currency area as "an economic unit composed of regions affected symmetrically by disturbances and between which labor and other factors production flow freely."

These characterizations of the optimal currency area in the literature usually lead to categorization of all the criteria into three. Firstly, the region should be subject to common sources of shocks and symmetric response to shocks. This means that shocks that are external to the region should induce the similar responses across the region, that is, the response of the states in the region to external shocks must be similar to ensure that the same monetary and fiscal policies can address shock recovery similarly across the region. Since the introduction of a single currency in a region means that the countries that form the region give up their autonomy over monetary policy, their individual ability to respond to external shocks by using monetary policy is also surrendered, therefore shock symmetry in the region ensures that common monetary policy is feasible for the region. "The loss of monetary flexibility has cost and benefit. One hand, a country that gives up its currency loses a stabilization devise targeted to domestic shocks, on the other hand, the country may gain credibility and thereby reduce undesired inflation" (Alesina and Barro, 2002). Alesina et al. (2002) also argue that the costs of losing monetary autonomy are lower when shocks are symmetric across that region.

Secondly, factor mobility within the region ensures that shocks to the region dissipates quickly and similarly across. Factors must be easily movable from surplus members states to deficit member states in the region in times where shocks to the region have asymmetric effects. This ensures full employment and price stability in the region. Lastly, fiscal integration is needed in the region to redistribute resources among the member state. This is a system where fiscal policies of the different states in the region are coordinated by a common federal institution like the IRS and congress of the United States. By this arrangement, collection and disbursement of certain taxes are done by federal institution and in time economic downturn, weak states can easily be bailed out through these arrangements.

As summarized by Bayoumi (1994), "the choice of a currency union depends upon the size of the underlying disturbances, the correlation between these disturbances, the costs of transactions across currencies, factor mobility across regions, and the interrelationships between demand for different goods." So the obvious question to ask is whether ECOWAS is an optimum currency area, that is, does the region satisfy the criteria for the introduction of a common currency? This is the question this study sets to investigate.

2. Evolution of the West African Monetary Union and West African Monetary Zone

According to Soyibo (1998) before ECOWAS was established in 1975, there were two monetary unions in West Africa. Under British colonial rule, Anglophone West Africa made up of Gambia, Ghana, British Cameroon, Nigeria and Sierra Leone

used a common currency, the British West African pound managed by the West African Currency Board. However, when Ghana gained independence in 1957 and establish her central bank, the Bank of Ghana, she began issuing her own national currency the cedi in 1958. Nigeria also issued her national currency, the naira, in 1958 with establishment of the Central Bank of Nigeria to replace the British West African pound. By 1968, the British West African pound collapsed when the other members issued their own currencies.

The francophone West Africa, made up of Benin, Burkina Faso, Côte d'Ivoire, Mali, Niger, Senegal, and Togo, also had and still has a common currency: the CFA franc inherited from France, the colonial rulers of these countries. The CFA franc survived the post independence collapse of monetary harmonization, unlike the case for Anglophone West Africa, and established the West African Economic and Monetary Union (WAEMU) in 1994 with a single central bank BanqueCentrale des Etats de l'Afrique de l'Ouest (BCEAO) and a common currency (CFA) which was fully convertible within the French franc zone. The WAEMU countries have common monetary and fiscal policies. Lending to government, for example, is fixed at 20 percent of the estimated revenue of the previous year (Soyibo, 1998).

The West African Clearing House (WACH), a multilateral payment system, was set up in 1975, immediately after the founding of ECOWAS to provide settlement services among the central banks and to facilitate the monetary integration process in the whole of West Africa. This has been transformed into West African Monetary Agency (WAMA) in 1996. A more comprehensive program called the ECOWAS Monetary Cooperation Programme (EMCP) was launched in 1987 with its main objective of creating a single monetary zone and introducing a common currency. The initial idea had been to introduce a single currency for all the member states of ECOWAS at a time, but this idea was later changed to the formation of a second monetary zone with a single currency, called the eco, when in April 2000 Accra Declaration four Anglophone members of ECOWAS Gambia, Ghana, Nigeria, Sierra Leone and one francophone member Guinea launched an initiative to establish the second monetary zone in West Africa. December 2000 Bamako Accord established the West African Monetary Zone (WAMZ), the West African Monetary Institute (WAMI) and Stabilization and Cooperation Fund (SCF) alongside eight-member francophone West African Economic and Monetary Union (WAEMU). WAMI was established by this accord to undertake all necessary tasks leading to the setting up of the West African Central Bank (WACB) and the introduction of a common currency (WAMI, 2002). The five countries had pledged to adopt a common currency by January 2003 and to work toward merging their planned monetary union with the WAEMU by January 2004 (Asante and Masson, 2001). These ambitious targets could not be met by these countries because of the failure to meet the set convergence criteria. Liberia later joined the WAMZ in February 2010 as the sixth member with Cape Verde an observer.

In November 2002 the Forum of Finance Ministers of WAMZ decided to facilitate the harmonization of fiscal and monetary policies by introducing two sets of convergence criteria, four primary and six secondary, for members. According to WAMI (2002), these criteria are as follows:

The primary criteria

(i) Achieve and maintain price stability by recording single digit end of period inflation rate by 2003 and 5 percent by 2004.
(ii) Ensure sustainable government fiscal position by reducing the ratio of budget deficit (excluding grants) on commitment basis to GDP to 4 percent or less throughout the period 2003–2005.
(iii) Limit Central Bank financing of government budget deficit as a percent of previous year's tax revenue to 10 percent or less throughout the period 2003–2005.
(iv) Maintain sufficient level of gross official foreign exchange reserves of at least 3 months of import cover throughout the period 2003–2005.

The secondary criteria

(i) Prohibition of new domestic arrears and liquidation of existing ones.
(ii) Tax revenue to GDP ratio equal to or greater that 20 percent.
(iii) Wage bill to tax revenue ratio equal to or less than 35 percent.
(iv) Public investment to tax revenue equal to or greater than 20 percent.
(v) Maintain real exchange rate stability.
(vi) Positive real interest rate.

The primary criteria would ensure that the economies of the member states converge in the sense of having symmetric shocks while the secondary criteria would ensure fiscal convergence. Throughout the period 2001–2009 only two countries, Gambia and Nigeria, satisfy all four primary criteria in 2007 and 2008 and only Gambia satisfies all criteria in 2008 and 2009. These developments brought a lot of doubts about the possibility of a successful introduction of a common currency, the eco, in the WAMZ. Debrun et al. (2005), for example, show that the proposed monetary union is not incentive compatible for most of the existing non-CFA members of ECOWAS unless there are institutional changes. A new time for the introduction of the new currency, by which it is hoped all the economies in the region will meet the convergence criteria, is 2015. These unsuccessful attempts at introducing the currency in the previous set dates also bring into focus the sustainability of the eco when it is introduced since there are still staggering efforts at introducing it.

3. Empirical literature

The empirical testing of the optimum currency area criteria has taken several forms including testing the synchronization of business cycles of the members of the region and measuring shock asymmetry of the countries in the region, indices, among others. Among the many studies that use the business cycles approach are Frankel and Rose (1996, 1997) and Kouparitas

(2001), and the general understanding is that the cost of losing autonomy over monetary policy will be lower if business cycles of the countries in the region synchronizes. Measurement of shock asymmetry using VAR has been done mainly for Europe, and the major studies in this area include Bayoumi and Eichengreen (1992), Kempa (2002) and Buigut and Valev (2005).

Bayoumi and Eichengreen (1997) construct an Optimum Currency Area (OCA) index for the European countries and use that to divide the countries in euro zone into three groups: high level of readiness, tendency to converge and little or no evidence to converge. Bayoumi and Ostry (2010) use correlation of output growth and inflation across countries in the regions and also regress real output per capita on its first and second lags and interpret the residuals to mean the underlying real output disturbances and conclude that there is little evidence that sub-Saharan African countries would benefit from currency union in the near future.

Unlike the European Union, studies on the ECOWAS monetary integration are scanty. Since the seminal work by Soyibo (1998), little empirical work has been done on the ECOWAS monetary integration process. Debrun et al. (2003) examine the rationale for establishing regional currency unions in western Africa and conclude that monetary unification might well be beneficial for a number of the member states of the Economic Community of West African States (ECOWAS) despite dramatic economic, political and historical differences between the two regions in the community. This is because the costs of these countries losing their monetary autonomy are often more than offset by the gains originating in the (partial) separation of monetary and fiscal powers. They argue however, that large countries with relatively ambitious public expenditure objectives, like Nigeria, would not be attractive partners because they would be expected to pressure the common central bank, creating excessive inflation in the entire union. Based on those arguments, they conclude that the desirability and sustainability of a currency union within ECOWAS critically depend on fiscal discipline among its members and on a strong fiscal surveillance procedure both in the transition phase and after the establishment of the union. Masson and Patillo (2003) conclude that "monetary union in West Africa can be effective agency of restraint on fiscal policies only if the hands of the fiscal policy authorities are also tied by a strong set of fiscal restraint criteria, applicable not just for accession to monetary union, but throughout the life of the union".

Ogunkola (2005) uses real exchange rate model to analyze the viability of a single monetary zone in ECOWAS and concludes that ECOWAS is closer to a monetary union than before. Debrun et al. (2005) also conclude, based on the calibration of their model, that lack of fiscal convergence, not the low level of regional trade or asymmetry of shocks, is the primary obstacle to the creation of a well-functioning and acceptable monetary union in West Africa. These two studies consider both the CFA and non-CFA zones and conclude based on the two zones forming a single monetary union.

On the failure of the introduction of the single currency for three consecutive times, Ojo (2005) notes that the failures are attributable to inadequate political commitment, political instability and inability to sufficiently carry along all the stakeholders in the process of program implementation. There is the need for the common market program to be implemented to complement the monetary integration program (Obaseki, 2005). Sagbamah (2005) highlights the important lessons of the European Union that should be learned by ECOWAS and provide the needed political will, social enlightenment campaign and mobilization, homogeneous product and financial markets, basic infrastructural production and economic structures, before transiting into a monetary union.

Debrun et al. (2005) are of the view that fiscal heterogeneity indeed appears critical in shaping regional currency blocs that would be mutually beneficial for all their members. In particular, Nigeria's membership in the configurations currently envisaged would not be in the interests of other ECOWAS countries unless it were accompanied by effective containment on Nigeria's financing needs. But Iyare et al. (2005) note that while fiscal convergence among members is desirable, other mechanisms like payment systems and labor mobility issues should be established beyond fiscal convergence, if such a union is to be successful.

Balogun (2007) estimates a dynamic panel data model using data available on West African Monetary Zone (WAMZ) countries and examines the monetary and macroeconomic stability perspective for entering into monetary union. By testing the hypothesis that independent monetary and exchange rate policies have been relatively ineffective in influencing domestic activities (especially GDP and inflation), and that when they do, they are counterproductive, he concludes that the members of the WAMZ would be better off surrendering their independence over some policy instruments to the planned regional body under appropriate monetary union arrangements.

Balogun (2009) examines the determinants of inflation differentials in a panel of West African Monetary Zone (WAMZ) states vis-à-vis its set benchmark for macroeconomic convergence since 2000. Over the sample period, he finds that the unweighted average regional inflation rates were most often above a single digit target and vary widely among the countries. The major monetary policy instruments determinants of inflationary divergence are the pursuit of distorted interest rates, exchange rates overvaluation and expansionary monetary policies.

It is clear from the empirical evidence that the ex ante conditionality for the introduction of the single currency in West African Monetary Union will be difficult to achieve. But it is possible, like the UEMOA countries, for the WAMZ to achieve optimality ex post. Achieving ex post optimum currency area can be ensured if there are common sources of shock and shock symmetry across the region and that is what this study sets out to measure.

4. Methodology

4.1. The SVAR model

The empirical analysis of shock asymmetry is based on the stochastic rational expectations open economy macroeconomic model developed by Clarida and Gali (1994) and also used by

Kempa (2002) to analyze the convergence of the euro zone countries an optimum currency area. "The model exhibits the results of the standard Mundell-Fleming-Dornbusch model in both the short run when prices adjust sluggishly to demand, money and supply shocks and long run properties that characterize macroeconomic equilibrium in the open economy once prices adjust full to all shocks" (Clarida and Gali, 1994).

Let $y_t = (x_{1t}x_{2t}x_{3t})'$ be a vector of endogenous variables where x_{1t} is a measure of growth of economic activity of a country relative to the US, x_{2t} is the change in bilateral real exchange rates between each country's currency and the US dollar and x_{3t} is the change in price level of each country relative to the US price level. The dynamic structural representation of the model is

$$\Gamma y_t = \mu + \sum_{j=1}^{p} B_t y_{t-j} + v_t \tag{1}$$

where Γ is a 3×3 matrix of contemporaneous coefficients among the endogenous variables, μ is a vector of constants, B_j is a 3×3 matrix of structural coefficients, v_t is a vector of orthogonal structural shocks to the system so that $\sum_v = E\left(v_t v_t'\right) = I$. The reduced form of Eq. (1) is

$$y_t = \Gamma^{-1}\mu + \sum \Gamma^{-1} B_t y_{t-j} + \Gamma^{-1} v_t \tag{2}$$

this can be written as

$$y_t = \nu + \sum_{j=1}^{p} \Theta_j y_{t-j} + e_t \tag{3}$$

where $\Gamma^{-1}\mu$, $\Theta_j = \Gamma_j^{-1} B_j$, and $e_t \Gamma^{-1} v_t$. Eq. (3) can also be written as

$$y_t = \nu + \Theta(L) y_t + e_t \tag{4}$$

where $\Theta(L) = L + L^2 + \cdots + L^p$ and L is a lag operator. Given that the system in Eq. (4) is stable, we can re-write (4) as a moving average representation, by Wold's decomposition.

$$(I - \Theta(L))\, y_t = \nu + e_t \tag{5}$$

$$y_t (I - \Theta(L))^{-1} \nu + (I - \Theta(L))^{-1} e_t \tag{6}$$

$$y_t = \mu_0 + \sum_{j=0}^{\infty} \Phi_j e_{t-j} \tag{7}$$

Now suppose, as in Blachard and Quah (1989), Clarida and Gali (1994) and Kempa (2002) that the estimated MA representation, based on estimation of the reduced form equation in (4), is given by

$$y_t = e_t + C_1 e_{t-1} + C_2 e_{t-2} + \cdots \tag{8}$$

and the true MA representation of the actual data generating process is

$$y_t = A_0 v_t + A_1 v_{t-1} + A_2 v_{t-2} + \cdots \tag{9}$$

from Eq. (3)

$$e_t = \Gamma^{-1} v_t \tag{10}$$

substituting Eq. (10) to Eq. (8) gives

$$y_t = \Gamma^{-1} v_t + C_1 \Gamma^{-1} v_{t-1} + C_2 \Gamma^{-1} v_{t-2} + \cdots \tag{11}$$

comparing Eqs. (9) and (11) give us

$$A_0 = \Gamma^{-1}, \quad e_t = A_0 v_t \quad \text{for} \quad j = 0 \quad A_j = C_j A_0 \quad \text{for} \quad j > 0 \tag{12}$$

This shows the relationship between the vector of structural shocks v_t and the vector of reduced form residuals e_t, which is equivalent to the C-model of Amisano and Giannini (1997). By knowing A_0, we can recover the structural shocks from the innovations. From Eq. (12) we can write

$$\sum\nolimits_e E(e_t e_t') = A_0 E(v_t v_t') A_0' = A_0 A_0' \tag{13}$$

$$\begin{pmatrix} w_{11} & w_{21} & w_{31} \\ w_{12} & w_{22} & w_{32} \\ w_{13} & w_{23} & w_{33} \end{pmatrix} = \begin{pmatrix} a_{110} & a_{210} & a_{310} \\ a_{120} & a_{220} & a_{320} \\ a_{130} & a_{230} & a_{330} \end{pmatrix} \begin{pmatrix} a_{110} & a_{120} & a_{130} \\ a_{210} & a_{220} & a_{230} \\ a_{310} & a_{320} & a_{330} \end{pmatrix}$$

$$w_{11} = a_{110}^2 + a_{210}^2 + a_{310}^2$$
$$w_{22} = a_{120}^2 + a_{220}^2 + a_{320}^2$$
$$w_{33} = a_{130}^2 + a_{230}^2 + a_{330}^2$$
$$w_{21} = w_{12} + a_{120}a_{110} + a_{220}a_{210} + a_{320}a_{310}$$
$$w_{31} = w_{13} + a_{130}a_{110} + a_{230}a_{210} + a_{330}a_{310}$$
$$w_{32} = w_{23} + a_{130}a_{120} + a_{230}a_{220} + a_{330}a_{320}$$

This is a system of 6 equations with 9 unknowns since $\sum_e$ is a symmetric matrix estimated from the VAR in Eq. (3), this implies that A_0 is not identified. In order to be able to identify A_0 and recover the structural shocks v_t we need to impose three additional restrictions on the elements of A_0. In this paper since the structural model derives from the structural model of Clarida and Gali (1994), the alignment of the shocks also follows. The shock to economic growth is aligned as the supply shock because supply shocks are known to be the main unexpected changes in output in developing countries especially. Shocks to real exchange rates are identified as demand shocks because these countries are import-dependent, so excess import demand drives exchange rates. Shocks to price changes are also labeled as monetary shocks because money is assumed to be neutral. Clarida and Gali (1994) and Kempa (2002) use Blachard and Quah (1989) decomposition to identify A_0. This decomposition states that "only supply shocks v_{1t} influence changes in real output levels in the long run, while both supply and demand shocks v_{2t} influence real exchange rates in the long run. Monetary shocks v_{3t} have no long run impact on either change in real output levels or real exchange rates" (Clarida and Gali, 1994). This statement imposes three restrictions on A_0. A short run view of these restrictions is

$$a_{210} = a_{310} = a_{320} = 0$$

given the arrangement of the variables in the VAR. Blachard and Quah (1989) restrictions are long run restriction; therefore the restrictions imply that

$$\sum_{i=0}^{\infty} a_{21i} = \sum_{i=0}^{\infty} a_{31i} = \sum_{i=0}^{\infty} a_{32i} = 0$$

These restrictions imply that the matrix

$$\sum_{j=0}^{\infty} A_j = \sum_{j=0}^{\infty} C_j A_0$$

is a lower triangular matrix. Blachard and Quah (1989) show that these restrictions identify A_0 and we can recover v_t as

$$v_t = A_0^{-1} e_t$$

In order to ensure the stability of the VAR and be able to explore it's properties I check the stationarity properties of the series using Augmented Dickey–Fuller test. The optimum lag order selection is based on Akaike Information Criterion.

4.2. Linear dependence of and feedback between the structural shocks

The linear dependence of two time series x_t and y_t can be decomposed into a sum of contemporaneous linear feedback between x_t and y_t, linear feedback from x_t to y_t and linear feedback from x_t to y_t. Geweke (1982) shows that if the series are stationary, nondeterministic, autoregressive and have moving average representation, then linear dependence of x_t and y_t ($F_{X,Y}$) can be decomposed as

$$F_{X,Y} = \hat{F}_{X\to Y} + \hat{F}_{Y\to X} + \hat{F}_{XY} \tag{14}$$

where $F_{X\to Y}$, $F_{X\to Y}$, and $F_{X\to Y}$ are calculated from the variances and covariance of the residuals in the following autoregressive models:

$$x_t = \sum_{s=1}^{p} E_{1s} x_{t-s} + u_{1t} \quad \hat{\Sigma}_1 = \hat{U}_1' \hat{U}_1 \tag{15}$$

$$x_t = \sum_{s=1}^{p} E_{2s} x_{t-s} + \sum_{s=1}^{p} E_{2s} y_{t-s} + u_{1t} \quad \hat{\Sigma}_2 = \hat{U}_2' \hat{U}_2 \tag{16}$$

$$y_t = \sum_{s=1}^{p} G_{1s} y_{t-s} + v_{1t} \quad \hat{T}_1 = \hat{V}_1' \hat{V}_1 \tag{17}$$

$$y_t = \sum_{s=1}^{p} G_{2s} y_{t-s} + \sum_{s=1}^{p} H_{2s} x_{t-s} + v_{2t} \quad \hat{T}_2 = \hat{V}_2' \hat{V}_2 \tag{18}$$

$$\hat{C} = \hat{U}_2' \hat{V}_2 \quad \hat{\Upsilon} = \begin{pmatrix} \hat{\Sigma}_2 & \hat{C} \\ \hat{C}' & \hat{T}_2 \end{pmatrix} \tag{19}$$

and

$$F_{X\to Y} = \ln\left(\frac{|T_1|}{|T_2|}\right), \quad F_{Y\to X} = \ln\left(\frac{|\Sigma_1|}{|T_2|}\right),$$

$$F_{X.Y} = \ln\left(\frac{|T_2|.|\Sigma_2|}{|\Upsilon|}\right), \quad F_{X,Y} = \ln\left(\frac{|\Sigma_2|.|T_1|}{|\Upsilon|}\right) \tag{20}$$

X and Y are linearly independent if and only if $\Sigma_1 = \Sigma_2$. Under the null hypothesis of no linear feedback where $n\hat{F}_{X,Y}$, $n\hat{F}_{X\to Y} n\hat{F}_{Y\to X}$, and $n\hat{F}_{X.Y}$ have chi-squared distribution with degrees of freedom $kl(2p+1)$, klp, klp, and kl, respectively, where k is the number of variables in x_t, l is the number of variables in y_t, p is the number of autoregressive lags and n is the number of observations.

Geweke (1982) is used to measure and decompose linear dependence between pairs of countries and compared with linear dependence of Germany, France, Spain, Italy and Greece to determine if the West African countries are ready for a monetary union. We expect the structural shocks of economies that converge to be linearly dependent.

4.3. Data

The data for the estimation of the models are extracted from International Financial Statistics (IFS) and Direction of Trade Statistics (DOTS) by the International Monetary Fund (IMF) and directly from some central banks and statistical organizations of some of the countries. The data on consumer price index and inflation for all the countries are extracted from October 2011 edition of IFS, except for Guinea and where these data are collected from the website of BanqueCentrale de la République de Guinée (BCRG) (bcrg-guinee.org). Data on nominal exchange rates of each of the countries are taken from the IFS except for Guinea where they are taken from the IFS for 1980 to 2005 and the rest of the years from the website of Institut National de la Statistique (stat-guinee.org) while the trade data are taken from DOTS. I use monthly data from February 1987 to April 2011 for all the series. The period of the data for the paper is chosen to insure that the data are available for all the variables for all the countries in the study.

In measuring the variables that go into the models, many studies use real GDP growth as a measure of real growth of the economic activity but in the context of developing countries such as the ECOWAS countries Bayoumi and Ostry (2010) notes that "in Africa many of the shocks which affect economies are temporary supply disturbances such as climatic shocks to agriculture or terms of trade disturbances". This is due to the subsistence nature of agriculture, which is the dominant sector in the economies of many of these countries. In this study I use growth in total trade of each these countries, that is, exports plus imports relative to US trade to measure growth of economic activity. The use of the trade data also makes it possible to use monthly data which increases frequency and range of the data. Therefore the real growth for country i in the region is measured as

$$x_{1i} = d\ln\left(\frac{(\text{exports} + \text{imports})_i}{(\text{exports} + \text{imports})_{US}}\right).$$

The exchange rate variables are bilateral real exchange rates of the countries' currencies to the US dollar. The real exchange rate for country i is measured as

$$x_{2i} = d(e_i - p_i + p_{us})$$

Table 1
Variance decomposition of the variables in the model.

Period	Gambia			Ghana			Guinea			Nigeria			Sierra Leone		
	Monetary	Demand	Supply	Monetary	Demand	Supply	Monetary	Demand	Supply	Monetary	Demand	Supply	Monetary	Demand	Supply
Variance decomposition of real growth															
1	0.01	0.34	99.65	0.09	1.94	97.97	0.41	0.28	99.31	0.1	0.19	99.71	0.04	9.23	90.73
3	0.31	0.49	99.2	0.14	2.4	97.47	1.49	0.75	97.76	0.24	0.73	99.04	0.12	12.03	87.84
6	0.31	0.49	99.2	0.48	2.59	96.93	1.5	0.86	97.64	0.24	0.73	99.04	0.3	12.59	87.11
12	0.31	0.49	99.2	0.49	2.61	96.9	1.5	0.86	97.64	0.24	0.73	99.04	0.31	12.59	87.1
24	0.31	0.49	99.2	0.49	2.61	96.9	1.5	0.86	97.64	0.24	0.73	99.04	0.31	12.59	87.1
36	0.31	0.49	99.2	0.49	2.61	96.9	1.5	0.86	97.64	0.24	0.73	99.04	0.31	12.59	87.1
Variance decomposition of real exchange rate changes															
1	0.425	99.211	0.364	1.908	96.042	2.05	0.485	97.951	1.564	0.375	99.605	0.02	7.85	85.392	6.758
3	1.689	96.976	1.335	1.35	94	4.651	0.916	97.234	1.85	0.549	98.47	0.98	11.685	81.941	6.374
6	1.716	96.95	1.334	1.439	92.696	5.865	0.931	96.349	2.72	0.553	98.402	1.044	12.505	81.093	6.402
12	1.716	96.95	1.334	1.61	92.454	5.936	0.931	96.348	2.721	0.553	98.402	1.044	12.535	81.061	6.404
24	1.716	96.95	1.334	1.61	92.452	5.938	0.931	96.348	2.721	0.553	98.402	1.044	12.536	81.06	6.404
36	1.716	96.95	1.334	1.61	92.452	5.938	0.931	96.348	2.721	0.553	98.402	1.044	12.536	81.06	6.404
Variance decomposition of price changes															
1	91.971	7.785	0.244	90.307	9.187	0.506	33.573	64.728	1.699	95.6	4.226	0.174	84.02	10.064	5.917
3	89.896	8.921	1.183	92.524	7.036	0.44	33.806	64.265	1.929	94.517	4.698	0.785	83.165	9.923	6.912
6	89.696	9.12	1.185	91.519	7.652	0.829	33.512	63.687	2.801	94.503	4.711	0.786	82.253	10.806	6.941
12	89.696	9.12	1.185	91.196	7.931	0.873	33.511	63.686	2.803	94.503	4.711	0.786	82.194	10.833	6.973
24	89.696	9.12	1.185	91.195	7.931	0.874	33.511	63.686	2.803	94.503	4.711	0.786	82.194	10.833	6.972
36	89.696	9.12	1.185	91.195	7.931	0.874	33.511	63.686	2.803	94.503	4.711	0.786	82.194	10.833	6.972

where e_i is the log of bilateral nominal exchange rate for country i, p_i is the log of CPI of country i and p_{US} is the log of CPI of the USA.

The price variable is measured according to Kempa (2002) where

$$x_{3i} = d \ln \left(\frac{p_i}{p_{US}} \right).$$

These variables are measured relative to the USA because the US dollar is seen as an anchored currency of these countries as shown in Alesina et al. (2002).

5. Empirical results

The measurement of the variables that go into the models makes them naturally to be stationary at their levels. However, ADF tests are used to formally check the stationarity properties and found that they do not have unit roots. Akaike Information Criterion is used to select the optimum lag for the models and 2, 5, 3, 2, and 3 lags are found to be optimum for the models of Gambia, Ghana, Guinea, Nigeria and Sierra Leone, respectively.

5.1. Variance decomposition

Variance decomposition is important in identifying the sources of variability in the variables in the models for each country in the region. This helps in determining whether the sources of shock to variables in the models are common across the region. Table 1 shows the variance decomposition of real growth of economic activity, real exchange rates and price level changes. The variance decomposition is presented for 1, 3, 6, 12, 24 and 36 lags to enable us compare the structure of the variance decomposition after the system stabilizes across. Panels a, b and c of Table 1 show the variance decomposition of real growth, real exchange rate change and price level changes, respectively for all the countries. Panel a shows that the supply shocks dominate variability in output growth throughout, explaining at least 99 percent for Gambia, Ghana and Nigeria. While the structure of the variance decomposition looks similar for these countries in the region, the magnitude looks different for Sierra Leone with a higher percentage of the variability in real growth explained by demand shocks. Panel b of shows that for all the countries in the region, demand shocks are dominant and persistent over time in explaining exchange rate variability. Demand shocks explain at least 97 percent of real exchange rate across the region for the 1-month ahead forecast variance and this stabilizes after third period except for Sierra Leone. In panel c, the pattern of the variance decomposition for price level changes is different across the region. At 36 lags, after the system stabilizes, about 90 percent of the variance for Gambia is explained by monetary shocks, 91 percent for Ghana, 34 percent for Guinea 95 percent for Nigeria and 82 percent for Sierra Leone. Clearly, the forecast variance of prices is explained by different shocks across the zone except for Ghana and Nigeria which are close for all the variables. This suggests that the sources of external shock to real output growth and real exchange rates in the region are common to the four countries but the sources of shock to price level changes are not common to any.

5.2. Impulse response functions

Impulse response functions of all the variables for all the countries in the region, which are not shown in the paper, show for each country the response of real growth to a 1-standard

deviation of supply, demand and monetary shocks. Also, the response of real exchange rate changes and price level changes, respectively to the same shocks is drawn. The graphs display the dynamics of how the variables respond to the shocks. On impact, the economies of all the countries in the region shrink at different rates. The time it takes for the shock to dissipate varies among the countries. While it takes Gambia about 6 periods for the shock to dissipate, it takes Ghana about 5 periods, while Sierra Leone's shock lingers through to the 10th period. The response to supply and monetary shock is not similar either. The response of real exchange rates changes and price level changes to all shocks across the region differs greatly in structure and intensity. The differences in the rate at which the shocks dissipate through impulse response functions of the countries show that these countries have asymmetric shocks which is further investigated in the next section using a correlation of the structural shocks.

5.3. Linear dependence of and feedback between the structural shocks

A measure of the level of convergence between the countries, in the sense of an optimum currency area, is shock symmetry between underlying structural shocks of the countries in the region. The size and correlation of the underlying disturbances are important for the choice of a currency union (Bayoumi, 1994). If two economies converge, we expect underlying disturbances to be linearly dependent, in the sense of Geweke (1982), because their response to the external shocks will be similar. Shocks are symmetric if and only if they are linearly dependent in this sense. The existence of feedback between the shocks of these countries in a region suggests that they have a mechanism to correct any imbalances that will arise as a result of external shocks that are specific to any of them. Also, linear dependence of shocks ensures that common policies transmit to these countries similarly. In this section we discuss the empirical results of measuring linear dependence and feedback of the structural shocks of the countries in the West African Monetary Zone (WAMZ) using Geweke (1982).

In order to put the results of the WAMZ countries in proper perspective, these same measures are computed for five European countries in the euro zone: France, Germany, Greece, Italy and Spain. These countries are chosen to include all the different characters within the euro zone presently. France and Germany remain strong after the introduction of the euro while Italy and Spain are troubled and Greece is at the brink. The idea is to

Table 2
Relationship between supply shocks.

	Gambia	Ghana	Guinea	Nigeria	Sierra Leone	France	Germany	Greece	Italy	Spain
Linear dependence										
Gambia										
Ghana	0.025									
Guinea	0.049	0.044								
Nigeria	0.018	0.057	0.007							
Sierra Leone	0.029	0.002	0.024	0.018						
France	0.065	0.087	0.046	0.051	0.051					
Germany	0.040	0.026	0.013	0.035	0.060	0.358				
Greece	0.041	0.030	0.033	0.075	0.051	0.218	0.291			
Italy	0.071	0.077	0.058	0.047	0.045	0.500	0.276	0.284		
Spain	0.057	0.038	0.045	0.077	0.039	0.254	0.138	0.220	0.213	
Contemporaneous linear feedback										
Gambia										
Ghana	0.004									
Guinea	0.008	0.014								
Nigeria	0.004	0.044	0.002							
Sierra Leone	0.010	0.000	0.000	0.000						
France	0.010	0.008	0.006	0.004	0.010					
Germany	0.036	0.015	0.004	0.010	0.026	0.263				
Greece	0.010	0.003	0.011	0.052	0.009	0.064	0.255			
Italy	0.019	0.005	0.014	0.009	0.002	0.474	0.182	0.115		
Spain	0.001	0.005	0.002	0.007	0.001	0.200	0.054	0.073	0.163	
Linear feedback										
Gambia	0	0.00	0.02	0.01	0.02	0.05	0.00	0.03	0.04	0.05
Ghana	0.02	0	0.02	0.01	0.00	0.03	0.00	0.03	0.04	0.03
Guinea	0.02	0.01	0	0.00	0.01	0.03	0.00	0.01	0.04	0.04
Nigeria	0.00	0.00	0.00	0	0.01	0.03	0.02	0.01	0.03	0.05
Sierra Leone	0.00	0.00	0.01	0.01	0	0.04	0.03	0.03	0.03	0.04
France	0.00	0.05	0.01	0.01	0.00	0	0.01	0.01	0.02	0.05
Germany	0.00	0.01	0.01	0.00	0.01	0.08	0	0.02	0.08	0.08
Greece	0.00	0.00	0.01	0.01	0.01	0.15	0.01	0	0.14	0.14
Italy	0.01	0.03	0.01	0.00	0.01	0.00	0.01	0.03	0	0.04
Spain	0.00	0.00	0.00	0.02	0.00	0.00	0.00	0.01	0.01	0

Table 3
Relationship between demand shocks.

	Gambia	Ghana	Guinea	Nigeria	Sierra Leone	France	Germany	Greece	Italy	Spain
Linear dependence										
Gambia										
Ghana	0.006									
Guinea	0.068	0.512								
Nigeria	0.042	0.035	0.015							
Sierra Leone	0.024	0.441	0.081	0.079						
France	0.054	0.558	0.009	0.019	0.245					
Germany	0.037	0.021	0.041	0.013	0.025	0.470				
Greece	0.026	0.541	0.012	0.014	0.178	0.101	0.107			
Italy	0.094	0.536	0.007	0.011	0.234	0.070	0.155	0.102		
Spain	0.074	0.540	0.019	0.008	0.249	0.155	0.139	0.090	0.163	
Contemporaneous linear feedback										
Gambia										
Ghana	0.000									
Guinea	0.000	0.000								
Nigeria	0.014	0.000	0.002							
Sierra Leone	0.011	0.006	0.000	0.070						
France	0.000	0.001	0.000	0.001	0.006					
Germany	0.000	0.002	0.000	0.000	0.000	0.399				
Greece	0.006	0.002	0.000	0.001	0.004	0.021	0.059			
Italy	0.014	0.000	0.002	0.001	0.000	0.041	0.061	0.028		
Spain	0.010	0.000	0.001	0.000	0.000	0.120	0.072	0.008	0.154	
Linear feedback										
Gambia	0	0.000	0.007	0.021	0.007	0.049	0.008	0.020	0.051	0.050
Ghana	0.005	0	0.511	0.019	0.399	0.538	0.003	0.527	0.533	0.539
Guinea	0.061	0.001	0	0.001	0.001	0.002	0.021	0.008	0.002	0.014
Nigeria	0.007	0.016	0.012	0	0.005	0.006	0.001	0.004	0.008	0.005
Sierra Leone	0.005	0.036	0.080	0.004	0	0.236	0.021	0.171	0.232	0.243
France	0.006	0.019	0.007	0.011	0.002	0	0.010	0.000	0.016	0.026
Germany	0.028	0.016	0.020	0.012	0.003	0.061	0	0.026	0.048	0.051
Greece	0.001	0.013	0.004	0.008	0.003	0.080	0.023	0	0.054	0.053
Italy	0.029	0.003	0.003	0.002	0.002	0.012	0.047	0.020	0	0.004
Spain	0.014	0.002	0.005	0.003	0.005	0.009	0.017	0.029	0.005	0

look at the coefficients of linear dependence and feedback that are calculated for these European countries against their current economic performance and use that information to discuss the results of the WAMZ countries. We mostly use the coefficients of France and Germany to indicate most convergent economies and the coefficient for Greece or Italy with France or Germany as the least convergent economies. We discuss linear dependence and feedback for supply, demand and monetary shocks across the WAMZ.

Tables 2–4 contain coefficients that measure linear dependence, contemporaneous feedback and feedback between countries in both directions. The tables contain the coefficients for supply, demand and monetary shocks, respectively. The coefficients at the upper part of the table are measures of linear dependence; those at the middle part are measures of contemporaneous linear feedback. The lower diagonal of the lower part of the table contains coefficients that measure feedback from supply shocks of countries in the row to supply shocks of countries in the column. The upper diagonal does the reverse feedback.

5.3.1. Supply shocks

In Table 2, France and Italy have the strongest linear dependence of 0.500 while France and Germany have 0.358. Spain has a coefficient of 0.139 with Germany and 0.213 with Italy, this sets an upper limit of 0.500 and a lower limit of 0.139 for judging the convergence of the WAMZ countries relative to the euro zone. As shown in Table 2, none of the WAMZ countries has a coefficient with any other that fall within this interval. All these countries fall far outside the range, even Ghana and Nigeria's coefficient of 0.057, which is the largest in the zone falls far short of the interval.

Using similar arguments for establishing intervals for linear dependence, the intervals for contemporaneous linear feedback of the supply shocks is 0.474–0.054. Clearly, from the middle segment of Table 2, all the WAMZ countries have feedback coefficients that are below the lower limit. These weak contemporaneous feedbacks imply that policies implemented in each country will have no effect in other and common policies will have different effects. For example, high rate of unemployment in Ghana will not be reduced by increased industrial activity in Nigeria and an expansionary monetary policy across the zone might be inflationary in Ghana and contained by the increased economic activity in Nigeria.

5.3.2. Demand shocks

In Table 3, France and Germany have the strongest linear dependence of 0.470 while France and Italy have the lowest of

Table 4
Relationship between monetary shocks.

	Gambia	Ghana	Guinea	Nigeria	Sierra Leone	France	Germany	Greece	Italy	Spain
Linear dependence										
Gambia										
Ghana	0.007									
Guinea	0.034	0.106								
Nigeria	0.031	0.083	0.018							
Sierra Leone	0.012	0.080	0.027	0.035						
France	0.130	0.172	0.035	0.040	0.061					
Germany	0.076	0.079	0.025	0.037	0.016	0.219				
Greece	0.017	0.143	0.005	0.012	0.073	0.052	0.089			
Italy	0.136	0.120	0.018	0.036	0.048	0.312	0.262	0.073		
Spain	0.055	0.115	0.034	0.010	0.049	0.214	0.072	0.073	0.226	
Contemporaneous linear feedback										
Gambia										
Ghana	0.002									
Guinea	0.002	0.001								
Nigeria	0.018	0.001	0.010							
Sierra Leone	0.001	0.001	0.002	0.023						
France	0.062	0.059	0.007	0.022	0.002					
Germany	0.029	0.028	0.006	0.022	0.003	0.160				
Greece	0.006	0.002	0.000	0.001	0.016	0.000	0.043			
Italy	0.070	0.010	0.000	0.024	0.000	0.280	0.193	0.009		
Spain	0.010	0.002	0.003	0.001	0.000	0.209	0.035	0.006	0.206	
Linear feedback										
Gambia	0	0.005	0.003	0.012	0.005	0.044	0.000	0.011	0.046	0.041
Ghana	0.000	0	0.102	0.033	0.079	0.110	0.027	0.128	0.107	0.114
Guinea	0.030	0.003	0	0.002	0.002	0.024	0.006	0.002	0.010	0.025
Nigeria	0.001	0.049	0.006	0	0.002	0.015	0.002	0.003	0.007	0.008
Sierra Leone	0.006	0.000	0.023	0.010	0	0.044	0.011	0.045	0.045	0.045
France	0.024	0.003	0.003	0.003	0.014	0	0.006	0.002	0.028	0.000
Germany	0.046	0.023	0.013	0.013	0.002	0.053	0	0.012	0.058	0.033
Greece	0.001	0.013	0.003	0.008	0.012	0.050	0.033	0	0.058	0.045
Italy	0.021	0.003	0.008	0.005	0.002	0.004	0.011	0.006	0	0.009
Spain	0.003	0.000	0.006	0.001	0.004	0.004	0.004	0.023	0.011	0

0.070 that give the upper and lower limits, respectively. Ghana-Guinea and Ghana-Sierra Leone have strong linear dependence of 0.512 and 0.441, respectively. These are stronger than all the European countries including France-Germany. In terms of demand shocks, Ghana and Guinea seem to have high shock symmetry.

Contemporaneous linear feedback is weak among the WAMZ countries and is virtually zero for all the WAMZ countries. The linear feedback is not much different between WAMZ and the European countries.

5.3.3. Monetary shocks

An equivalent interval derived from Table 4 for Gewekey linear dependence is 0.312–0.052. Only Ghana-Guinea coefficient of 0.101 falls within this interval. None of the WAMZ countries fall within the interval for the contemporaneous linear dependence. The feedback between monetary shocks of the WAMZ countries is as strong as that of the European countries, including France and Germany.

6. Conclusions

This paper investigates whether West African Monetary Zone (WAMZ) is a common currency area by using a structural VAR of real growth, real exchange rates and price level of five of the six countries in the West African Monetary Zone (WAMZ). WAMZ is a smaller group of countries within Economic Community of West African States (ECOWAS) that is in the process of introducing a single currency the eco. The identification of the structural shocks is based on Blachard and Quah (1989).

The evidence from the variance decomposition of the variables in the SVAR suggests that the region does not have common sources of shock. Also, the impulses response functions and the analysis of the structural shocks suggest that the countries in the region do not respond symmetrically to all external shocks. These suggest lack of ex-ante convergence in the region to form an optimum currency area. However, Ghana and Guinea seem to be close, both in commonness of sources of shock and symmetry of shocks, and may be able to cope with a single currency since the sources of shocks and shock recovery rate between them is somehow similar. A piecemeal approach to monetary union may be adopted where Ghana and Guinea adopt a single currency and the other countries ascend to it over time. This arrangement, however, may have serious implications for the other countries that are not in the union on the onset because as shown by Bayoumi (1994), while the gains from the monetary union in the form of lower transaction costs are limited to the members, the losses from the union in the form of lower output

affect every country in the region. Unlike the Eurozone where Bayoumi and Eichengreen (1997) find a core group of countries within the union that is a common currency area, the findings suggest that WAMZ does not have such a group.

These results confirm some previous studies on Economic Community of West African States (ECOWAS) and contradict others. The results of Bayoumi and Ostry (1997) on Sub-Saharan Africa "indicate little evidence that Sub-Saharan African countries would benefit in the near future from larger currency unions" but Debrun et al. (2003) conclude that monetary union in ECOWAS might be beneficial for a number of the member states. Debrun et al. (2005) also conclude that because of the fiscal heterogeneity of the countries in the union, Nigeria especially might not be compatible with the rest of the countries. Ogunkola (2005) also concludes that further convergence of the economies in the region is required for a stable region-wide monetary union in West Africa.

The results, however, contradict Balogun (2007) that argues that the countries of the WAMZ are better off surrendering their economies to a common monetary policy. This directly suggests that these countries are better of with a common currency. Also, Debrun et al. (2005) argue that asymmetric shocks are not the problem but lack of fiscal convergence. Even though the current study is on a sub set of ECOWAS, we can interpret the results together with Debrun et al. (2005) to mean that both asymmetric shocks and lack of fiscal convergence are the obstacles to the introduction of the common currency.

Lessons from the current euro crisis, suggest that fiscal integration should precede the introduction of a single currency even if the region satisfies all the other criteria, which is not the case for WAMZ. There is also the need for further policy harmonization and removal of barriers to factor mobility to enable transmission of shocks through these economies to synchronize.

References

Alesina, A., Barro, R.J., 2002. Currency unions. Q. J. Econ. 117 (2), 409–436.

Alesina, A., Barro, R.J., Tenreyro, S., 2002. Optimal Currency Areas. NBER Working Paper, 9072.

Amisano, G., Giannini, C., 1997. Topics in Structural VAR Econometrics. Springer.

Asante, R.D., Masson, P.R., 2001. Point/counterpoint: the pros and cons of expanded monetary union in West Africa. Finance and development. Q. Mag. IMF 38 (1).

Balogun, E.D., 2009. Inflation Differential in the West African Monetary Zone (WAMZ) Area: Implications for Unionization MPRA Paper No. 13045, Online at http://mpra.ub.uni-muenchen.de/13045/

Balogun, E.D., 2007. Monetary Policy and Economic Performance of West African Monetary Zone Countries. MPRA Paper, 4308, Online at http://mpra.ub.uni-muenchen.de/4308/

Bayoumi, T., 1994. A formal model of optimum currency areas. Staff Pap. Int. Monet. Fund 41 (4), 537–554.

Bayoumi, T., Eichengreen, B., 1992. Shocking Aspects of Monetary Unification. NBER Working Paper, 3949.

Bayoumi, T., Eichengreen, B., 1997. Ever closer to heaven? An optimum-currency-area index for European Countries. Eur. Econ. Rev. 41 (1997), 761–770.

Bayoumi, T., Ostry, J.D., 2010. Macroeconomic shocks and trade flows within Sub-Saharan Africa: implications for optimum currency arrangements. J. Afr. Econ. 6 (3), 412–444.

Bayoumi, T., Ostry, J.D., 1997. Macroeconomic shocks and trade flows within Sub-Saharan Africa: implications for optimum currency arrangements. J. Afr. Econ. 6 (3), 412–444.

Blachard, O.J., Quah, D., 1989. The dynamic effects of aggregate demand and supply disturbances. Am. Econ. Rev. 79 (4), 655–673.

Buigut, Valev, 2005. East and Southern African monetary integration: a structural vector autoregression analysis. World Dev. 33 (12), 2119–2133.

Clarida, R., Gali, J., 1994. Sources of real exchange rate fluctuations: how important are nominal shocks? Carnegie-Rochester Conf. Ser. Pub. Policy 41, 1–56.

Debrun, X., Masson, P., Pattilo, C., 2005. Monetary union in West Africa: who might gain, who might lose, and why? Can. J. Econ. 38 (2), 454–481.

Debrun, X., Masson, P., Patillo, C., 2003. West African currency unions: rationale and sustainability. CESifo Econ. Stud. 49 (3), 381–413.

Eichengreen, B., 1991. Is Europe a Common Currency Area? NBER, 3579.

Frankel, J., Rose, A., 1996. A panel project on purchasing power parity: mean reversion within and between countries. J. Int. Econ. 40, 209–224.

Frankel, J., Rose, A., 1997. Is EMU more justifiable ex post than ex ante? Eur. Econ. Rev. 41, 753–760.

Geweke, J., 1982. Measurement of linear dependence and feedback between multiple time series. J. Am. Stat. Assoc. 77 (378), 304–313.

Iyare, S.O., Lorde, T., Francis, B., 2005. West African States (Ecowas). West Afr. J. Monet. Econ. Integr. 5 (2(a)).

Kempa, B., 2002. Is Europe converging to optimality? On dynamic aspects of optimum currency areas. J. Econ. Stud. 29 (2), 109–120.

Kenen, P.B., 1969. The Theory of Optimum Currency: An Eclectic View.

Kouparitas, 2001. Is the United States an Optimum Currency Area? An Empirical Analysis of Regional Business Cycles. Federal Reserve Bank of Chicago, WP-01-22.

Masson, P., Patillo, C., 2003. Monetary union in West Africa: an agency of restraint for fiscal policies? J. Afr. Econ. 11 (3), 387–412.

McKinnon, R.I., 1963. Optimum currency areas. Am. Econ. Rev. 53, 717–725.

Mundell, R.A., 1961. A theory of optimum currency areas. Am. Econ. Rev. 51, 657–665.

Obaseki, P.J., 2005. The future of the West African Monetary Zone (WAMZ) Programme. West Afr. J. Monet. Econ. Integr. 5 (2(a)).

Ogunkola, O., 2005. An Evaluation of the Viability of a Single Monetary Zone in ECOWAS. African Economic Research Consortium (AERC), Nairobi, Research Paper 147.

Ojo, M.O., 2005. Towards a common currency in West Africa: progress, lessons and prospects. West Afr. J. Monet. Econ. Integr. 5 (2(a)).

Sagbamah, 2005. Perspectives on the European monetary union: lessons for the Economic Community of West African States (ECOWAS). West Afr. J. Monet. Econ. Integr. 5 (2(a)).

Soyibo, A., 1998. International payments system: West Africa 'common currency' is it possible or necessary? In: Presentation at a workshop on International Payments system within ECOWAS Countries, held in Accra-Ghana, March 30–31, 1998 in CEPA.

WAMI, 2002. Questions and Answers on the West African Monetary Zone. Accra, Ghana.