

## On The Feasibility of a Common Currency in West Africa: Evidence from a Multivariate Structural VAR

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**Abstract:** This study investigates the feasibility of proceeding with the proposed common currency in West Africa. By relying on the multivariate Structural Vector Autoregressive Approach (SVAR), the study focuses on the symmetry, magnitude and variance decompositions of four underlying structural shocks (external/global shocks, domestic supply shocks, domestic demand shocks and exchange rate shocks) as a precondition for forming an optimal currency area. The study also emphasizes the alternative techniques of adjustment to asymmetric disturbances for economies in the sub-region. The findings reveal that there is a relatively high degree of symmetry in the responses of the economies to external disturbances, while about 90% of the correlations in supply, demand and monetary shocks among West African countries are asymmetric. There are also qualified evidences that support the notion of low potential for factor mobility, intra-regional trade and openness across West African member States. The impulse responses among the countries are also dissimilar, suggesting that a Common Currency is not feasible in West Africa at the moment since the costs will outweigh the benefits. An incremental convergence approach to the introduction of a Common Currency in the region is recommended as the most viable option for West Africa.

**Keywords:** Common currency, ECOWAS, OCA, structural VAR

### INTRODUCTION

Regional integration, perceived as a means of ameliorating poverty among the peoples of West African states and a prelude to the creation of an Africa-wide currency union, has been the goal of the Economic Community of West African States (ECOWAS) which was founded in 1975.

In April 2000, ECOWAS adopted a strategy of a two-track approach to the creation of a common currency in the area. For the first track, the non-WAEMU members of ECOWAS were to form a second monetary union called the West African Monetary Zone (WAMZ) by July 2005, with the second track being the subsequent merging of WAEMU and WAMZ to form a single currency union in the region with a common currency—the eco. To achieve the first track, leaders of six West African countries, namely: Nigeria, Ghana, Guinea, Liberia, Gambia and Sierra Leone declared their intention to proceed to a monetary union among the non-CFA franc countries of the region. The six countries committed themselves to reducing central bank financing of budget deficits to 10 percent of the previous year's government revenue; reducing budget deficits to 4 percent of GDP by 2003; creating a Convergence Council to help coordinate macroeconomic policies; and setting up a common central bank—the West African Central Bank. The first track has been realized in 2005 while efforts are still ongoing to achieve the second track.

Undoubtedly, the feasibility of a wider monetary unification in ECOWAS poses several economic and institutional problems as discussed by Tsangarides and Qureshi (2008) and Masson and Pattillo (2005). First, with the political dependence of most monetary authorities in ECOWAS on their national governments, their central banks are often under pressure to finance government deficits and undertake over-expansionary monetary policies. In West Africa, fiscal problems (resulting from undue dependence of the monetary authorities on their national governments) are much more severe and the credibility of monetary institutions is much more fragile. Second, if the unification of WAMZ and WAEMU and the adoption of the eco are realized, it is uncertain that the French Treasury's guarantee of convertibility of WAEMU's currency (the CFA franc) to the euro at a fixed parity would continue for a monetary union of the expected size. Other problems include the membership of the relatively large Nigeria economy (and the effects of its fiscal/monetary activities), the overlapping membership of many ECOWAS countries and the implications of the global financial crisis. Also, given the debt and financial crisis facing members of the European Monetary Union (EMU), especially the euro-zone member states, a thorough appraisal of the feasibility of the proposed eco is desirable to ascertain if the proposed Currency Union is workable and sustainable. The objective of this study is, thus, to investigate whether or not the proposed Common Currency in West Africa is economically

feasible or viable. To achieve this, the study focuses on the symmetry of shocks accruing to ECOWAS economies, the magnitude of impulse responses of the economies to the structural shocks and the decomposition of the shocks into their components.

The standard framework used by economists to examine the desirability or viability of a monetary union is the Optimal Currency Area (OCA) theory introduced by Mundell (1961) and McKinnon (1963) and elaborated by Blanchard and Quah (1989), Vaubel (1978) and Krugman (1993), among others. The OCA theory focuses on whether or not the existence of a single currency in a particular geographical region would maximize economic efficiency. In other words, are the costs of forming a common currency less than the associated costs of exchange rate adjustments between countries in the event of macroeconomic shocks? According to Mundell (1961), this would be true in a situation in which the shocks were symmetric because this would entail all countries following the same adjustment policies, thus individual currencies will serve no purpose. But Mundell (1961) did not provide the technique for identifying and decomposing structural shocks. It was Blanchard and Quah (1989) who provided the empirical foundation of the OCA theory through their technique of identifying and decomposing structural shocks. Notably, when economies surrender their national currencies, the management of shocks (macroeconomic disturbances or national business cycles) is left to other policy instruments such as fiscal policy. But, since macroeconomic disturbances affect different economies differently, the analysis of costs of forming a currency union has been understandably concentrated on:

- The symmetry/asymmetry of shocks
- The alternative adjustment mechanisms such as the degree of trade/openness, labor/factor mobility and wage/price flexibility

Thus, the main criteria of the Optimum Currency Area (OCA) are summarized in the degree of symmetry/asymmetry of business cycles across economies and the alternative ways of adjustment to non-synchronicity to these national business cycles (shocks). Depending on the extent to which these conditions are met, individual countries may enjoy benefits or suffer losses by joining a currency union. Some of the benefits accruable include: lower transaction costs, price stabilization, improved efficiency of resource allocation, enhanced trade and increased access to factor, labor and financial markets, among others. Costs include loss of seignorage privilege and the sovereignty to maintain national monetary and exchange rate policies (Tsangarides and Qureshi, 2008; Karras, 2006; De Grauwe, 2005). Technically, the costs and benefits that may accrue to

members of a monetary union can be measured by the symmetry (positive correlation) or asymmetry (negative correlation) of responses to exogenous disturbances affecting the members. Costs tend to be lower if the disturbances are symmetric and markets are flexible i.e., factor, labor and financial markets are quick to adjust back to equilibrium, and higher conversely.

A few recent studies have investigated the cost and benefit of adopting a common currency in Sub-Sahara Africa and specifically in West Africa. Most of the studies use the Vector Autoregressive (VAR) approach which was developed by Blanchard and Quah (1989) to estimate the asymmetry of shocks accruing to different sub-regions in West Africa. In the ECOWAS sub-region, Addison *et al.* (2005) apply a VAR model to the West African Monetary Zone (WAMZ) countries and find very low cross country correlations of terms of trade shocks and real exchange rate shocks. Debrun *et al.* (2005) use a conjectured model about the fiscal-monetary policy mix in the region to assess the potential for monetary integration in ECOWAS. Their findings provide evidence of fiscal heterogeneity and abrogate Nigeria's membership of the union as non-beneficial unless it was accompanied by effective containment of Nigeria's financing needs. Be'nassy-Que're' and Coupet (2005) use crisp cluster analysis to examine different monetary arrangements in sub-Saharan Africa. Their results again suggest that Nigeria should not form part of WAMZ, while the creation of the enlarged WAEMU and WAMZ zone in ECOWAS appear to be more economically viable without Nigeria. For East Africa, Buigut and Valev (2005) test the symmetry of underlying structural shocks in the region and find that the supply and demand shocks are generally asymmetric but that the magnitude (size of the impulse response coefficient) and speed of adjustment to shocks are congruous among the countries. Houssa (2008) uses a dynamic factor model to examine the economic costs of a monetary arrangement in West Africa. His findings show negative and low positive correlations among supply disturbances across the countries, with greater similarity in the demand shocks among WAEMU countries.

A consideration of the various contemporary studies on the proposed West African Monetary Union indicates that they all adopt a two-variable modeling approach, consisting always of demand and supply shocks. This study however, intends to bring additional value to literature in this area by extending its study to a multivariate (four-variable) structural vector autoregressive model to capture the correlation of external shocks and monetary shocks among countries. Thus, this study will further expand the predictive and objective capacity of decision on the viability of the proposed Currency Union in West Africa.

**THE PROCESS OF ECOWAS INTEGRATION**

**Criterion 1: The degree of intra-regional trade and openness:**

**The degree of intra-regional trade:** The literature on optimal currency area emphasizes trade as the main channel through which benefits from a common currency will be enjoyed. The more countries trade with each other, especially in a particular region, the more they will value regional exchange rate stability. In this regard, currency unions are expected to be welfare enhancing because they reduce the potential disruptions to intra-regional trade brought about by relative price fluctuations and disturbances in bi-lateral exchange rates. Moreover, Frankel and Rose (1996) provide empirical evidence to show that trade has positive

impacts on growth and a common currency encourages trade in turn.

Table 1 indicates that the diversification index for all the West African economies in 2009 and 2010 are high, with Mali having the highest value of 87% and Togo, the least value of 69% in 2010. Notably, in GATT negotiated tariff reduction, the concessions exchanged among the industrial countries are usually in commodity categories that these countries export to each other. Only to the extent that LDCs' exports to OECD countries overlap the commodities exchanged by the DCs themselves, would any benefits flow to the LDCs from such GATT tariff cuts. The primary export structure (with limited range of products for export) of the ECOWAS economies promises little benefits from international trade and is the reason for high D.I and low T.C.I across West African states. Following the D.I

Table 1: Trade concentration and diversification indices of merchandise exports and imports by countries, annual 2009-2010, of ECOWAS economies

Economies	2009			2010		
	Absolute values	T.C.I	D.I	Absolute values	T.C.I	D.I
Benin	140	0.35	0.75	138	0.37	0.75
B. Faso	93	0.52	0.81	118	0.50	0.82
C. d'Ivoire	166	0.36	0.71	180	0.35	0.70
Gambia	18	0.35	0.72	23	0.32	0.69
Ghana	222	0.46	0.83	228	0.46	0.82
Guinea	92	0.61	0.80	92	0.44	0.81
G. Bissau	12	0.89	0.75	12	0.89	0.75
Mali	167	0.57	0.83	137	0.63	0.87
Niger	84	0.43	0.86	100	0.38	0.80
Nigeria	250	0.83	0.84	185	0.77	0.80
Senegal	195	0.24	0.72	190	0.27	0.75
S. Leone	217	0.24	0.64	220	0.27	0.71
Togo	167	0.20	0.69	165	0.21	0.69

UNCTAD, UNCTADstat;

D.I = Diversification index. This index signals how the structure of exports or imports by product of a given country or group of countries differ from the structure of product of the world. The index ranges from 0 to 1 and reveals the extent of the differences between the structure of trade of a country (or country group) and the world average. An index value closer to 1 indicates a bigger difference of the structure of product of a country from the world average (Finger and Kreinin, 1979);

T.C.I = Trade concentration index: This index shows how exports and imports of individual countries or group of countries are concentrated on several products or otherwise distributed in a more homogeneous manner among a series of products. Trade concentration index which is also called Herfindahl-Hirschmann index is, thus, a measure of the degree of market concentration. It has been normalized to obtain values ranking from 0 to 1. A value of 1 indicates maximum trade concentration

Table 2: Trade openness (in % of nominal GDP) from 2005-2010

Year	2005	2006	2007	2008	2009	2010
Economy						
Benin	22.81	25.88	33.8	32.01	29.16	31.681
Burkina Faso	18.73	20.58	20.1	20.62	19.94	22.762
Cape Verde	46.20	52.01	56.1	57.17	48.16	50.202
Cote d'Ivoire	49.07	46.60	46.3	45.80	45.26	44.764
Gambia	29.86	33.26	32.6	26.06	26.57	21.410
Ghana	29.36	31.45	31.4	32.98	34.56	34.578
Guinea	33.40	40.33	31.7	41.63	27.33	37.753
Guinea Bissau	21.78	21.63	27.8	27.46	24.04	24.656
Liberia	129.6	170.8	163	195.4	125.7	116.61
Mali	30.83	34.40	33	38.04	28.95	31.314
Niger	25.58	24.68	25.4	28.62	38.91	39.975
Nigeria	37.05	33.79	35.9	34.99	31.02	33.975
Senegal	36.61	35.16	38	41.09	34.01	34.437
Sierra Leone	21.65	21.79	20.4	20.72	20.49	30.418
Togo	48.73	47.17	47	45.51	46.79	45.702

United Nations Conference on Trade and Statistics (UNCTADstat); Trade openness which indicates roughly the size of international trade is calculated as average of exports and imports as a percentage of nominal Gross Domestic Product (GDP)

and T.C.I criteria, one can aver that the ECOWAS region may be incapable of harnessing the benefits of a currency union at the moment.

**The degree of trade openness:** Due to scant statistics on intra-regional trade across ECOWAS member states, we examine the size of international trade (represented by trade openness) across West African states in Table 2.

Large size of international trade, like intra-regional trade, might contribute to more similar economic

conditions despite differences in specialization. However, Table 2 shows that the degree of trade openness is generally low. Bulk of the figures is below the 50% benchmark. This is indicative of poor state of economic ties across the economies.

**Criterion 2: The degree of labor and factor mobility:**

In his seminal work, Mundell (1961) argues that an Optimal Currency Area (OCA) is a group of countries in which labor and factor mobility is relatively high. Due to scant statistics on cross-country labor flow in

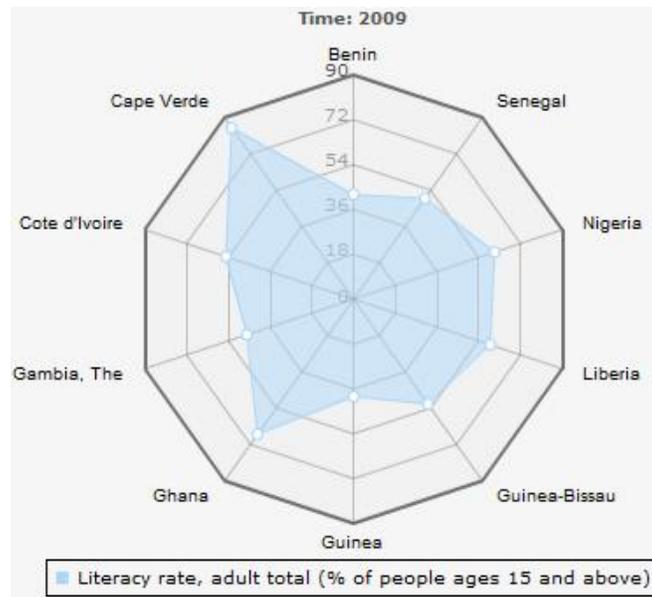


Fig. 1: Fusion chart of total adult literacy rate (in percent) of people of ages 15 years and above in 10 ECOWAS member states

Table 3: Total (all-sector) labor force employment and agricultural labor force employment in ECOWAS economies, 2005-2010 (in thousands)

Year		2005	2006	2007	2008	2009	2010
Economy	Sector						
	Benin	All sectors	3212	3334	3456	3580	3698
Burkina Faso	All sectors	1556	1582	1607	1631	1653	1674
	Agric. sector	6275	6488	6699	6908	7137	7366
Côte d'Ivoire	All sectors	5677	5892	6120	6351	6589	6835
	Agric. sector	7522	7709	7911	8126	8367	8606
Gambia	All sectors	3053	3052	3057	3062	3068	3074
	Agric. sector	681	701	722	743	765	788
Ghana	All sectors	535	550	565	581	596	612
	Agric. sector	9851	10114	10379	10647	10944	11232
Guinea	All sectors	5411	5516	5664	5790	5922	6058
	Agric. sector	4397	4500	4610	4720	4850	4988
Guinea-Bissau	All sectors	3606	3668	3731	3801	3879	3964
	Agric. sector	605	617	631	645	660	676
Mali	All sectors	449	457	462	470	478	486
	Agric. sector	3388	3480	3578	3672	3767	3869
Niger	All sectors	2420	2464	2511	2551	2592	2635
	Agric. sector	4198	4326	4463	4592	4803	4973
Nigeria	All sectors	3639	3764	3895	4036	4183	4336
	Agric. sector	44906	46110	47330	48613	49998	51349
Senegal	All sectors	12376	12341	12312	12285	12257	12230
	Agric. sector	4769	4923	5078	5242	5408	5580
Sierra Leone	All sectors	3454	3541	3642	3742	3845	3952
	Agric. sector	1952	2007	2055	2102	2141	2188
Togo	All sectors	1215	1241	1261	1281	1300	1320
	Agric. sector	2594	2680	2772	2866	2962	3059
		1329	1352	1375	1399	1424	1449

United Nation Conference on Trade and statistics (UNCTAD stat); Chart developed from data sourced from literature; Burkina Faso, Mali, Niger, Togo and Sierra Leone are not included in Fig. 1 due to insufficient data

the region, adult literacy rate or expenditure on education (a measure of the potential for human capital development and labor mobility) and the number of labor employed in agricultural/all sectors are employed as crude estimators of intra-regional labor mobility (Buigut and Valev, 2005; Chuku, 2012). Table 3, depicts the structure of labor force in ECOWAS economies, showing clearly the thousand number of labor employed in all sectors and those employed in agricultural sector between 2005 and 2010.

The structure of labor force in Table 3 indicates that the influential agricultural sector accounted for 53 to 95% of the total employed labor in these economies. Since agriculture as a primary sector requires a large unskilled labor force which has low occupational mobility, we do not expect very high level of labor and factor mobility given the prevailing state of the economy. In terms of adult literacy rate, Fig. 1 shows that adult literacy level has been low, indeed less than 40% in most of the economies, except in Cape Verde and Ghana. Again, this is a pointer to poor potential for intra-regional labor mobility. Literacy rate is highest in Cape Verde followed by Ghana.

### ECONOMETRIC MODEL AND DATA

**Methodology:** From the analytical point of view, we emphasize the symmetry of underlying disturbances (structural shocks), the responses of the economy to these disturbances (impulse responses) and the decomposition of these shocks into the component sources.

**The model (Structural Vector Autoregressive, SVAR, model):** Let us consider a structural Moving Average (MA) of a vector of variables  $X_t$  and an equal number of structural shocks,  $\varepsilon_t$ , so that:

$$X_t = A_0\varepsilon_t + A_1\varepsilon_{t-1} + A_2\varepsilon_{t-2} + \dots = \sum_{i=0}^{\infty} A_i\varepsilon_{t-i} \quad (1)$$

Recall that a Moving Average stochastic process (MA) is simply a linear combination of white noise innovations (Gudjarati, 2004: 839) in matrix form, equation 1 can be written as:

$$X_t = A(L)\varepsilon_t \quad (2)$$

where,  $X_t = [\Delta y_t^*, \Delta y_t, \Delta e_t, \Delta p_t]'$ , comprising world real GDP denoted by  $y_t^*$ , domestic real GDP denoted by  $y_t$ , real exchange rate denoted by  $e_t$  and domestic price level denoted by  $p_t$  all in log-difference forms.

$A$  is a 4\*4 matrix that defines the impulse response coefficients of endogenous variables to structural shocks  $\varepsilon_t = [\varepsilon_t^{s*}, \varepsilon_t^s, \varepsilon_t^d, \varepsilon_t^m]'$  consisting of external world supply shock ( $\varepsilon_t^{s*}$ ), domestic supply shock ( $\varepsilon_t^s$ ), domestic demand shock ( $\varepsilon_t^d$ ), and monetary shock ( $\varepsilon_t^m$ )

respectively. The Impulse Response Function (IRF) traces the dynamic effects of a one-time (or a one-standard deviation or a one cholesky's factor) shock to one innovation (or shock to one endogenous variable) on the current and future values of the other variables in the SVAR (EViews 5.0 User Guide, p.715).

We assume that the structural shocks ( $\varepsilon_t$ ) are serially uncorrelated and orthonormal. The assumption that  $\varepsilon_t$  is orthonormal implies that the covariance matrix is normalized to the identity matrix such that:  $E[\varepsilon_t \cdot \varepsilon_t'] = 1$

**The decomposition of the structural model:** By specifying four kinds of shocks, namely, shocks to world real GDP, domestic real GDP, real effective exchange rate and inflation, the decomposition of the series is done as follows:

$$\Delta y_t^* = A_{11}(L)\varepsilon_t^{s*} \quad (3)$$

$$\Delta y_t = A_{21}(L)\varepsilon_t^{s*} + A_{22}(L)\varepsilon_t^s + A_{23}(L)\varepsilon_t^d + A_{24}(L)\varepsilon_t^m \quad (4)$$

$$\Delta e_t = A_{31}(L)\varepsilon_t^{s*} + A_{32}(L)\varepsilon_t^s + A_{33}(L)\varepsilon_t^d + A_{34}(L)\varepsilon_t^m \quad (5)$$

$$\Delta p_t = A_{41}(L)\varepsilon_t^{s*} + A_{42}(L)\varepsilon_t^s + A_{43}(L)\varepsilon_t^d + A_{44}(L)\varepsilon_t^m \quad (6)$$

The decomposition presented in Eq. (3) through (6) is simple and intuitive. They imply that world GDP is not endogenous (i.e., it is strictly exogenous) to country-specific domestic structural shocks, while all domestic variables are affected by shocks to global output. Thus, as regards the effects of the shocks on the variables, we make the following assumptions:

- Global real GDP is posited to be strictly exogenous. This is based on the understanding that all the ECOWAS economies are relatively small and open economies, having no significant contribution to global output.
- Domestic real GDP is affected only by external shocks and shocks from itself in the long-run. However, it is not affected by monetary shocks ( $\varepsilon_t^m$ ) or demand shocks ( $\varepsilon_t^d$ ). This restriction is in line with Blanchard's natural rate hypothesis and it implies that:  $\sum_{i=0}^{\infty} A_{21i} \neq 0$ ,  $\sum_{i=0}^{\infty} A_{22i} \neq 0$ ,  $\sum_{i=0}^{\infty} A_{23i} = 0$  and  $\sum_{i=0}^{\infty} A_{24i} = 0$ .
- The real effective exchange rate is assumed to be affected by external shocks, domestic supply shocks and domestic demand shocks, but it is not affected in the long-run by a monetary shock. This restriction implies that,  $\sum_{i=0}^{\infty} A_{34i} = 0$ .
- The domestic price level is assumed to be strictly endogenous, implying that the prices are affected

by shocks in global GDP (external shocks), domestic supply shocks, demand shocks and monetary shocks too.

The entire model can be rewritten as a system of structural equations as follows:

$$\begin{bmatrix} \Delta y_t^* \\ \Delta y_t \\ \Delta e_t \\ \Delta p_t \end{bmatrix} = \begin{bmatrix} A_{11}(L) & 0 & 0 & 0 \\ A_{21}(L) & A_{22}(L) & 0 & 0 \\ A_{31}(L) & A_{32}(L) & A_{33}(L) & 0 \\ A_{41}(L) & A_{42}(L) & A_{43}(L) & A_{44}(L) \end{bmatrix} \begin{bmatrix} \varepsilon_t^{s^*} \\ \varepsilon_t^s \\ \varepsilon_t^d \\ \varepsilon_t^m \end{bmatrix} \quad (7)$$

Following Amisano and Giannini (1997) and Huang and Guo (2005), we do not directly recover estimates of the structural shocks from the structural moving average model in equation 1. Rather, we estimate a reduced-form (modified) VAR model for the observed variables. In the passing, recall that an Autoregressive process (AR) per se is an “a theoretical” and stochastic process in which each endogenous variable is expressed as a function on its own lagged value(s). In the modified VAR model, the external variables follow a pure Autoregressive (AR) process in that it is expressed solely as a function of its own lagged value(s). But the three domestic (endogenous) variables are modeled as functions of their own lags and the lags of the external variables. Thus:

$$\Delta y_t^* = \Phi + \sum_{i=1}^n \Psi_i \Delta y_{t-i}^* + \mu_t^1 \quad (8)$$

And

$$X_t = \Omega + \sum_{i=1}^n \alpha_i X_{t-i} + \sum_{i=1}^n \Omega_i \Delta y_{t-i}^* + \mu_t \quad (9)$$

where,  $X_t = [\Delta y_t, \Delta e_t, \Delta p_t]'$ ,  $\alpha_i$  and  $\Omega_i$  are coefficient matrixes, while  $\mu_t^1$  and  $\mu_t = [\mu_t^2, \mu_t^3, \mu_t^4]$  are reduced-form or observed residuals (mixture of structural innovations). Thus, the reduced-form innovations ( $\mu_t$ ) are composites of structural innovation ( $\varepsilon_t$ ).

Assume that the first difference transformation will make the variables stationary; the structural innovations can safely be recovered from the reduced-form residuals. In fact, it can be shown that structural innovations can be recovered as linear combinations of reduced-form innovations. The reduced-form innovations are indeed composites of the structural innovations (Buigut and Valev, 2005). Following Haung and Quah (2005), recovering structural innovations involves a special decomposition of reduced-form innovations which is achieved by OLS estimation of Eq. (9).

We can write Eq. (9) as a MA representation of the form:

$$X_t = \theta + \sum_{i=1}^n G_i \mu_{t-i} \quad (10)$$

where,

$$\theta = (I - \sum_{i=1}^n \Gamma_i)^{-1} (\tau + \sum_{i=1}^n \Omega_i \Delta y_{t-i}^*) \quad (11)$$

Notice that Eq. (10) is a mere elaboration of the Moving Average (MA) process in Eq. (1)

The term  $G_i$  is called impulse response and is procured from:

$$\sum_{j=0}^{\infty} G^j L^j = (I - \sum_{i=1}^n \Gamma_i L^i)^{-1} \quad (12)$$

As we see in quantitative econometrics software (Eviews 5.0 User Guide: 717), Amisano and Giannini (1997) demonstrate that the class of SVAR that E views estimates may be written as:

$$G_0 \mu_t = A_0 \varepsilon_t \quad (13)$$

where, as usual,

- $\mu_t$  = Observed or reduced-form innovation
- $\varepsilon_t$  = Unobserved or structural innovation
- $G_0 \& A_0$  = k\*k matrixes to be estimated
- $G_0$  = Estimates of the coefficients in the reduced-form (SVAR) model.
- $A_0$  = Impulse response coefficients from the Impulse Response Function (IRF)

The assumption that the structural innovations are orthogonal which means that its covariance matrix is an identity matrix,  $E[\varepsilon_t \cdot \varepsilon_t'] = 1$ , imposes the following identifying restrictions on  $G_0$  and  $A_0$ :

$$G_0 \cdot E[\varepsilon_t \cdot \varepsilon_t'] \cdot G_0' = A_0 A_0' \quad (14)$$

Noting that the expression on either side of Eq. (14) are symmetric, this imposes k (k+1)/2 restrictions on the  $2k^2$  unknown elements of  $G_0$  and  $A_0$ . Therefore, in order to identify  $G_0$  and  $A_0$ , we need to supply at least  $2k^2 - k(k+1)/2 = k(3k-1)/2$  additional restrictions. These restrictions imply that  $A(L)$  is the unique Cholesky lower triangle. Thus, it is sufficient to identify the structural  $A_i$  matrix and the time series of structural shocks  $\varepsilon_t = [\varepsilon_t^{s^*}, \varepsilon_t^s, \varepsilon_t^d, \varepsilon_t^m]'$  by using  $\varepsilon_t = A_0^{-1} \mu_t$ . In other words, structural shocks can be recovered as linear combinations of reduced-form innovations.

By computing the correlation of the shocks in West African economies, we can evaluate the feasibility of a common currency in the region. Positive and significant (above 50%) correlation coefficients signals that countries will require a synchronous policy response which is crucial for a centralized monetary policy management in the region.

**Data description:** Annual data for the 15 ECOWAS economies are used for the study. The sample covers the period between 1970 and 2010. This time frame will

give us the benefit of also accounting for the effects of the 2007/08 global financial shocks (which is an example of an external global shock) on the domestic economies. The data sets are extracted from the International Financial Statistics (IFS) CD-ROM published by the International Monetary Fund (IMF), World Development Indicators CD-ROM published by the World Bank and the United Nations Conference on Trade and Statistics (UNCTAD stat). Domestic output is proxied by country GDP at 2000 constant US\$. The real exchange rate series are sourced from IMF's IFS and it is computed based on unit labor cost for a basket of 26 advanced countries and the Euro area as a group.

real output, domestic real output, real effective exchange rate and price level all contain unit roots for each economy, although the degree of significance varies across economies and variables. This means that these time series are integrated of order one,  $I(1)$ . Thus, the first differences of the variables are used to ensure stationarity. The tests for stability using the Autoregressive (AR) root tables and graphs show that all the roots have modulus less than one and lie inside the unit circle. Thus, the SVAR is covariance stationary. For the estimation of the empirical four-variable SVAR, the number of lags is set to two in all cases since both the Akaike Information Criterion (AIC) and the Swartz Information Criterion (SIC) indicate that all the models have an optimal lag length of one or two. The lag length of two ensures that the estimates from the structural VAR are consistent. The results of the autocorrelation LM test indicate absence of serial correlations in the SVAR estimates.

**ANALYSIS AND INTERPRETATION OF RESULT**

**Identifying the shocks (preliminaries):** The result of unit root test conducted on the external variables and the three endogenous variables reveal that the global

Table 4: Correlation of domestic supply shocks (1970-2010)

	BEN	BFA	CIV	GHA	GMB	GNB	MLI	NER	NGA	SEN	SLE	TGO
BEN												
BFA	0.390668											
CIV	-0.001280	0.16736										
GHA	0.444769	-0.02153	0.01566									
GMB	-0.488420	-0.40972	0.05693	-0.266971								
GNB	-0.041810	0.05741	0.45853	0.005645	0.042029							
MLI	-0.123980	-0.45583	0.18484	0.215272	0.149476	0.168221						
NER	0.033878	-0.14163	0.46151	-0.064208	0.059004	0.234455	0.23589					
NGA	-0.123750	-0.05411	-0.15817	0.226164	0.028088	-0.05391	0.27125	0.13584				
SEN	0.009940	0.26035	0.32464	-0.114236	-0.03400	-0.07206	-0.00012	0.337343	0.388066			
SLE	0.124415	-0.06515	-0.28445	-0.075074	-0.12648	-0.08705	-0.30679	0.168883	-0.15416	0.150150		
TGO	-0.080080	0.32288	0.18857	-0.102086	0.057211	0.54737*	-0.06802	0.088962	-0.23691	-0.056306	-0.59009	

Study; \*: Indicates statistical significance at the 5% level; Positive and statistically significant correlation indicates symmetry while negative correlation shows asymmetry

Table 5: Correlation of domestic demand shocks (1970-2010)

	BEN	BFA	CIV	GHA	GMB	GNB	MLI	NER	NGA	SEN	SLE
BEN											
BFA	0.275897										
CIV	0.901450*	0.43995									
GHA	-0.901960	-0.73880	-0.745198								
GMB	-0.206477	-0.36490	-0.163687	0.17821							
GNB	0.149318	-0.12270	0.103819	0.14995	0.07926						
MLI	0.762114*	0.28560	0.844976*	-0.83309	-0.06922	-0.060611					
NER	0.687885*	0.14509	0.415088	-0.32378	-0.19812	-0.091722	0.293246				
NGA	0.182076	0.11911	0.119662	0.00722	0.41077	0.150673	0.006054	0.205233			
SEN	0.899574*	0.37619	0.721119*	-0.40824	-0.27064	-0.155634	0.488182	0.625049*	0.137101		
SLE	0.046311	0.06279	-0.100126	0.05484	0.31876	0.076871	-0.044445	-0.114266	0.467333	0.125952	
TGO	0.736375*	0.62205*	0.391169	-0.76328	-0.32413	-0.293418	0.477974	0.593830*	-0.012301	0.909701*	0.222

Study; \*: Indicates statistical significance at the 5% level; Positive and statistically significant correlation indicates symmetry while negative correlation shows asymmetry

Table 6: Correlations of monetary shocks (1970-2010)

	BEN	BFA	CIV	GHA	GMB	GNB	MLI	NER	NGA	SEN	SLE	TGO
BEN												
BFA	0.45908											
CIV	0.71685*	0.44156										
GHA	0.12032	0.05803	0.22902									
GMB	-0.43876	0.29354	-0.04230	-0.147020								
GNB	0.19532	-0.05986	0.31372	0.196278	-0.047930							
MLI	0.20019	0.25274	0.34163	0.305991	-0.006120	-0.20456						
NER	-0.11700	0.01127	0.35823	0.555528*	0.421608	0.46751	0.05174					
NGA	0.09481	0.25855	0.17187	0.328525	-0.019690	0.00249	0.06675	0.49110				
SEN	0.09365	0.27368	0.17136	0.204153	0.258959	-0.22042	0.50246*	0.21135	-0.15287			
SLE	-0.08582	0.48170	-0.20820	0.193474	0.125919	0.16120	-0.34010	-0.32060	-0.05741	-0.33142		
TGO	0.26188	0.29114	0.49380	-0.092500	0.114068	0.19876	-0.11750	0.45670	0.33426	-0.08787	0.2035	

Study; \*: Indicates statistical significance at the 5% level; Positive and statistically significant correlation indicates symmetry while negative correlation shows asymmetry

Table 7: Correlations of external shocks (1970-2010)

	BEN	BFA	CIV	GHA	GMB	GNB	MLI	NER	NGA	SEN	SLE	TGO
BEN												
BFA	0.600660											
CIV	0.825764	0.749436										
GHA	0.882794	0.213373	0.787410									
GMB	0.654078	0.825929	0.642248	0.71938								
GNB	0.760926	0.688270	0.726639	0.81609	0.79914							
MLI	0.780583	0.589356	0.664514	0.66710	0.68392	0.8200						
NER	0.647833	0.912585	0.580019	0.34354	0.56209	0.7955	0.94704					
NGA	0.705246	0.812499	0.729067	0.69618	0.86463	0.7318	0.78675	0.68658				
SEN	0.803723	0.969643	0.578422	0.75918	0.82707	0.6902	0.78069	0.81141	0.8153			
SLE	0.778261	0.880291	0.765641	0.75855	0.91222	0.8396	0.73196	0.62908	0.9346	0.85797		
TGO	0.570103	0.254114	0.517046	0.66192	0.27491	0.6774	0.78814	0.70066	0.3949	0.52795	0.26163	

Study; \*: Indicates statistical significance at the 5% level; Positive and statistically significant correlation indicates symmetry while negative correlation shows asymmetry

**Correlation of structural shocks:** Table 4, 5, 6 and 7 report the correlation of identified structural shocks. The positive and statistically significant results indicate symmetric correlation. Symmetric or synchronous correlations are asterisked and red-underlined. The more symmetric the shocks are, the more feasible it becomes for the West African states to operate a common currency. We first look at the domestic supply shocks in Table 4 as they are more critical since they are more likely to be invariant to demand management policies (Bayoumi and Eichengreen, 1994; Buigut and Valev, 2005; Chuku, 2012).

**Correlation of domestic supply shocks:** Regrettably, the contemporaneous supply shocks are largely asymmetric. Where the correlation are positive, they are small and insignificant which reflect the differences in the core primary export commodities as discussed in section 2. Only the supply shocks for Togo and Guinea Bissau are significant and positively correlated. This result shows that policy synchronization among the West African countries may be ineffective since the economies would require different policy responses to adjust to these asymmetric supply shocks.

**Correlation of demand shocks:** Out of the 66 pairs of ECOWAS member states examined, only eleven countries have significant symmetric correlation in domestic demand shocks. This is indicative of the weak inter-demand relationships among West African countries. None of the WAMZ member states has symmetric correlation in demand shock. The preponderance of asymmetric correlation in demand shocks among WAEMU countries is similar to the finding by Fielding and Shield (2001) for CFA zone of which WAEMU is a subset.

**Correlation of monetary shocks:** As regards the correlations of monetary shocks, out of the 66 pairs of West African countries considered, only 3 pairs of countries have symmetric correlation in monetary shocks. Intuitively, this result follows from non-synchronicity of demand shocks among the economies. In specifics, the symmetric correlation of monetary shocks occurs between Benin and Cote d'Ivoire

(0.71685), Niger and Ghana (0.555528) and between Senegal and Mali (0.50246).

**Correlation of external shocks:** From Table 7, the correlations of external shocks are highly significant for most West African countries except for four pairs of countries. This is attributable to the similarity in the primary export-oriented structure of most West African economies (Chuku, 2012). Ceteris paribus, the higher the correlation of shocks from the external source, the greater will be the benefit for countries in the region to form a currency union. But we must caution that there should not be much fuse about these results because synchronous external shocks almost always tends to be associated with similarity in export-structure (Haung and Guo, 2005). Thus, the high degree of synchronicity in the correlation of external shocks must be interpreted with a grain of salt.

**The dynamics of shocks:** The dynamic effect of the structural shocks on the current and further values of the endogenous variables is captured by the impulse response and variance decomposition analysis. While the impulse response function traces the dynamic effect of a one time (or one standard deviation) shock to one innovation (or one endogenous variable) on the current and future values of other variables in the VAR system, the variance decomposition separates (or decomposes) the variation in an endogenous variable into the component shocks to the VAR (Haung and Guo, 2005; Eviews 5.0 User Guide, p.715).

**The impulse response function:** The impulse response graphs (functions) in Fig. 2 measure the dynamic effect of a one-standard deviation of a particular structural shock (supply shock, demand shock and monetary shock) on Real Effective Exchange Rate (REER) over a range of 10-year period for each West African State under analysis

What emerges from Fig. 2 is that the response of real effective exchange rate to demand shocks and monetary shocks have been variegated but fairly distributed between negative and positive values. Overall, dissimilar patterns surface across the board, when the impact of the structural demand shocks is

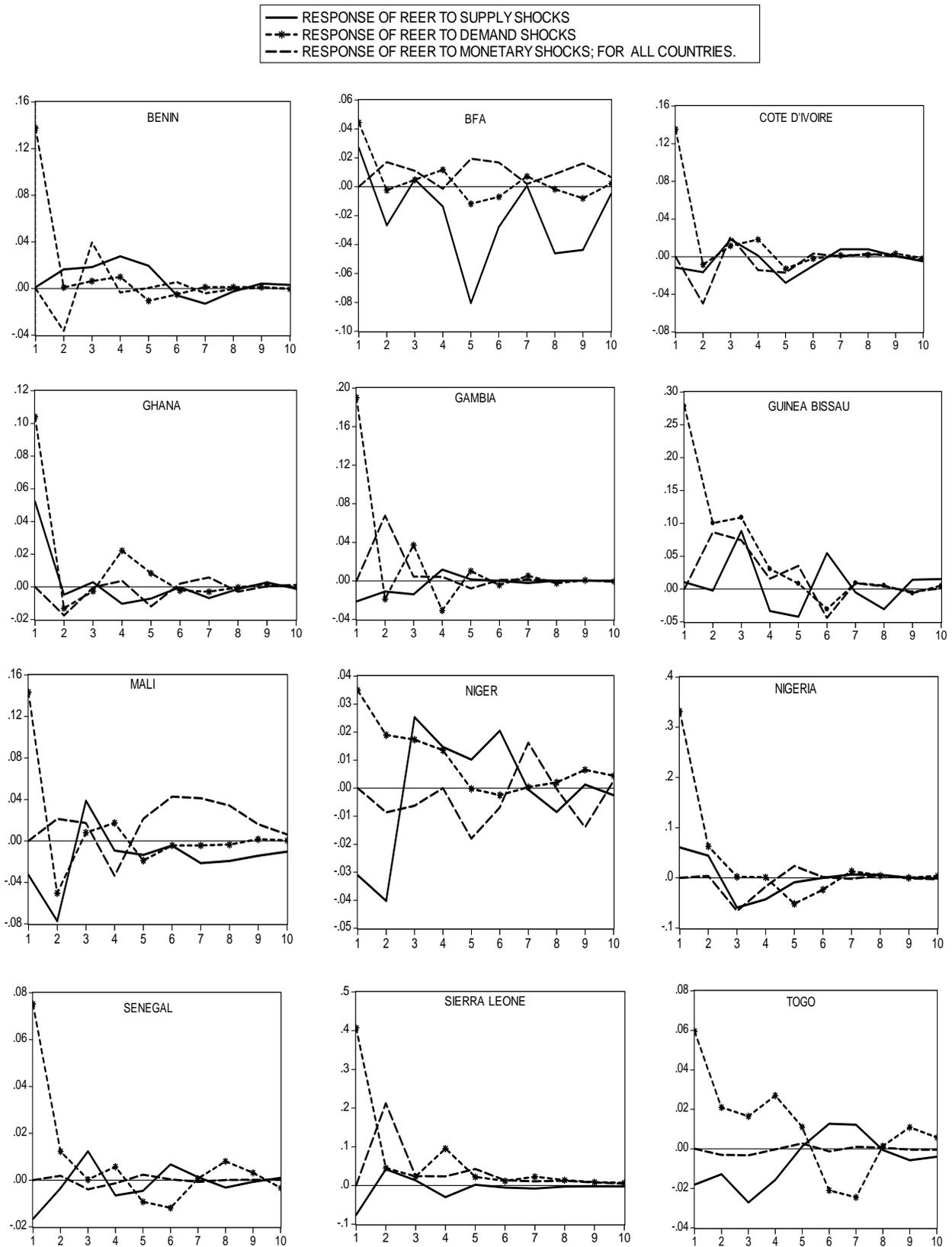


Fig. 2: Impulse responses of Real Effective Exchange Rate (REER) to structural shocks Study; Each of graphical functions in Fig. 2 is generated as combined graphs of the responses of REER to three shocks (supply, demand and monetary shocks)

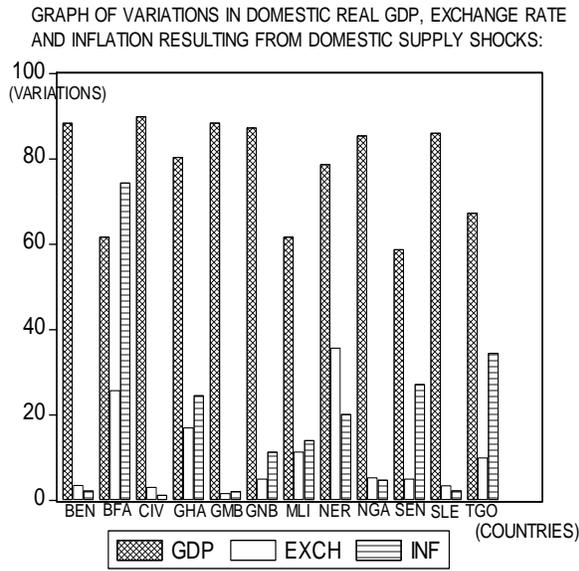


Fig. 3: The relative impact of supply shocks on the variation in the endogenous variables across West African states (Study)

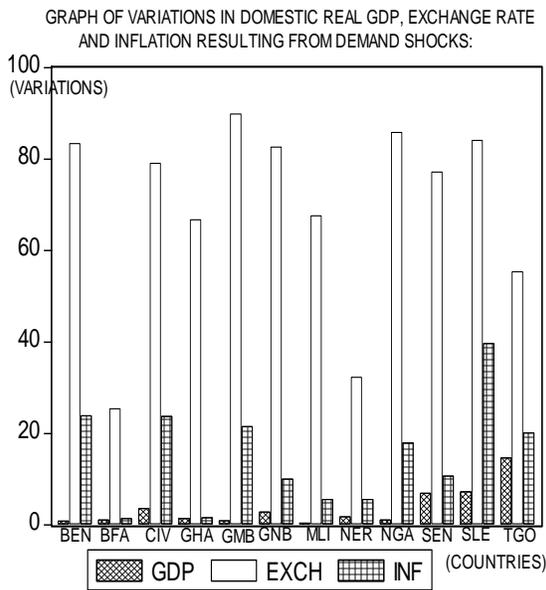


Fig. 4: The relative impact of demand shocks on the variation in the endogenous variables across West African states (Study)

looked at. An instant positive or negative response of real exchange rate can be observed which later trail off with a downward or upward trend. After some years, the effects edges towards zero. As regards the effects of supply shocks, it can be observed that it provokes both a positive and negative response of the real exchange rate for West Africa economies, although the time path and magnitude of responses vary.

The ambiguous effects of a typical supply shock on the real exchange rates and the variation in the later on

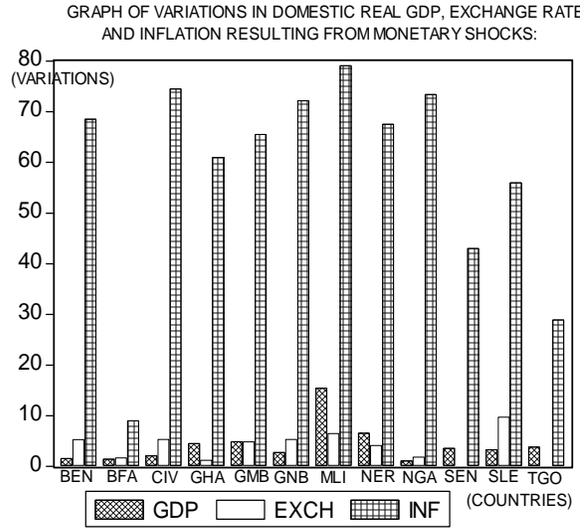


Fig. 5: The relative impact of monetary shocks on the variation in the endogenous variables across West African states (Study)

trade/economic magnitudes (for different West African economies) appear consistent with what the theoretical macroeconomics predicts. Theoretically, an increase in exchange rate volatility should be a hindrance to trade flows. However, various empirical analyses show that the effects of exchange rate volatility on trade (and on virtually any macroeconomic aggregates) are ambiguous. This difference between theoretical postulates and empirical findings has been termed the exchange rate disconnect puzzle (Obstfeld and Rogoff, 2000). Undoubtedly, as long as exchange rate volatility affects transaction costs and adjustment to such cost is neither free nor automatic, trade flows will be negatively affected. But irrespective of empirical findings on the effects of exchange rate variability on trade and other macroeconomic variables, there is potential for a single monetary zone to positively affect intra-regional trade in West Africa. What is needed is proper harmonization and coordination of policies necessary for the pursuance of a currency union in region.

**Variance decomposition:** By showing the contribution of each shock to the movement in an economic variable, the variance decomposition gives an indication of which shock is more predominant in accounting for the variability in the variable. This is important because differences in the cause of the variability in the countries could be indicative of underlying differences in transmission mechanism and policy strategies of West African economies, which may be potential obstacles to regional monetary unification. Figures 3, 4 and 5 show the impact of various shocks on each of the endogenous variables, namely, domestic real GDP, Real Effective Exchange Rate (EXCH) and the rate of Inflation (INF) across

ECOWAS economies. The responses to the shocks are measured as an average of a medium time (10-year) horizon from the variance decomposition estimates.

Figure 3 shows that supply shock exerted the highest degree of swings on domestic real GDP.

Figure 4 shows that demand shocks exerted the highest degree of swings on exchange rate.

Figure 5 show that monetary shocks exerted the highest degree of swings on inflation.

Overall, the variance decomposition analysis above shows that shock from the monetary sector is the major cause of domestic price fluctuations across ECOWAS member states while demand and supply shocks are largely responsible for the variability in exchange rate and domestic real output respectively. Demand shocks provoked the largest amount of variation in exchange rate (Fig. 4). This is a pointer to the fact that the strengthening the inter-demand relation by improving intra-regional trade, for instance, will make exchange rate a less compelling adjustment tool and hence reduce the cost of introducing a common currency (Haung and Guo, 2005). Monetary shocks provoked the highest degree of variability in inflation (Fig. 5). This is an affirmation of “The Monetarists” position that inflation is always and everywhere a monetary phenomenon.

## CONCLUSION AND RECOMMENDATIONS

In this study, we have committed ourselves to an evaluation of the feasibility of the proposed common currency in West Africa as the region is moving inexorably towards closer monetary cooperation. A multivariate structural VAR model was used to examine the symmetry of four kinds of disturbances affecting the region. They include external shocks, supply shocks, demand shocks and monetary shocks. Countries having positive and significantly correlated shocks are categorized as potential candidate for the proposed currency union. This is because synchronicity of national business cycles across the region implies that the economies are amendable to similar region-wide policy measures. The study also emphasized the responses of the economy to the disturbances (impulse responses) and the decomposition of the disturbances into the component sources. The decomposition/disaggregation of the shocks is important because differences in the cause of the variability in the countries could be indicative of underlying differences in policy strategies and transmission mechanisms which may be potential obstacles to regional monetary unification.

In general, the correlations of structural shocks are asymmetric between the WAEMU and WAMZ countries, and among WAMZ countries, than they are among WAEMU countries. Further, results from the impulse responses of real exchange rate to structural shocks show that the later do not converge. Therefore,

it will not ideal to adopt a one-size-fits all exchange rate policy across the region. In line with the findings by Chuku (2012) and Taylor (2010) policy makers in West Africa should consider delaying the introduction of the proposed eco and work further towards stronger integration of the ECOWAS economies in terms of improvement in intra-regional trade and factor/labor mobility. This can be achieved through improvement and expansion in the network of infrastructure in the region as these will enhance the effectiveness of the alternative ways of adjustment to asymmetric disturbances, say, by improving the trade flow and factor mobility. Delaying the launch of the proposed eco will also afford policy makers the opportunity to learn from the prevailing debt and financial crisis being experienced in the Euro zone with a view to building pre-emptive strategies.

Finally, based on the findings from this study, Policy Makers in West Africa should adopt “Incremental Convergence” approach to the introduction of a Common Currency in the region. This would involve:

- Reducing the number of starting countries
- Effecting the necessary policy reform with a view to improving the conditions for an OCA
- appraising and reappraising the performance of the countries and taking off with those that satisfy the conditions
- Admitting new countries that later meet the criteria

In line with Taylor (2010), the finding from this study does not support selective expansion of the Existing Monetary Union (WAEMU) as prescribed by Masson and Pattillo (2005). It does not appear that there is any underlying reason why this strategy should be more successful. One argument may be that in being pegged to the Euro (externally determined), this encourages stability for the currency. This argument is no longer plausible given the debt and financial crisis rocking the member states of Euro zone and its implications on the stability of the CFA franc that is pegged to the Euro. In fact, the CFA franc countries may have something to learn from the proposed eco in terms of eco's roots as an indigenous currency. The internal elements of eco may grant African countries a sense of ownership and responsibility to the currency and its underlying policies, possibly making them more responsible in decision making processes. Apart from reflecting a sense of involvement, it also forces them to become more engaged about the issues that they face and potential solutions that may exist.

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