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Dynamic Macroeconomic Convergence in the West Africa Monetary Zone (WAMZ)

Anokye M. Adam[1]

Daniel Agyapong[2]

Emmanuel Numapau Gyamfi[3]

Abstract: The paper empirically investigates the issue of macroeconomic convergence in the West Africa Monetary Zone (WAMZ) using monthly data from 1990:01 to 2010:05 as part of the ongoing discussion on the single currency for West Africa, The ECO initiative. The study specifically examines exchange and inflation rates convergence and finds no evidence of convergence in inflation in the WAMZ and little support for convergence in exchange rate. The findings imply that WAMZ is not ready for a single currency and that the decision to postpone the introduction of the Eco to 2015 is in a right direction. The possibility of introducing the ECO requires a change of macroeconomic policy direction of member countries due to evidence of divergence in inflation across the region and higher distance to convergence.
Key words: macroeconomic convergence; West Africa Monetary Zone

1. INTRODUCTION

In April 2000, The Gambia, Ghana, Guinea, Nigeria, and Sierra Leone later joined by Liberia announced their intention to create the West African Monetary Zone (WAMZ) and agreed to adopt a single currency as the region decides to move towards monetary integration. It has been argued that monetary integration provides much needed exchange rate and price stability, reduces transaction cost in regional trade and economies in the use of foreign reserves. The proposed single currency is expected to stimulate intra-regional trade, capital flows and investments, increase growth and employment and improve balance of payments performance. In addition, monetary integration, they argued, would enhance economic efficiency and strengthen the capacity of the region to compete internationally.

[1] PhD Candidate of Open University of Malaysia (Accra Institute of Technology Study Centre) and a lecturer at Department of Accounting and Finance, School of Business, University of Cape Coast, Cape Coast, Ghana. Email: ano77chie@yahoo.co.uk.
[2] PhD Candidate of Open University of Malaysia (Accra Institute of Technology Study Centre) and a lecturer at Department of Management Studies, School of Business, University of Cape Coast, Cape Coast, Ghana. Email: agyapongdan@yahoo.co.uk.
[3] A lecturer at Ghana Institute of Management and Public Administration (GIMPA), Accra, Ghana. Email: winterblaze1707@gmail.com.
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However, the success of the monetary integration and for that matter single currency centres on economic convergence. Without economic convergence, policy coordination, which is the corner stone of monetary integration, becomes extremely difficult. Lack of convergence would threaten stability of the monetary union. Jayaraman, Ward and Xu (2007) argued that a currency union, from which there is no easy exit for any member country, will have to adopt one common set of monetary, exchange rate and fiscal policies for dealing with external and internal shocks, which are expected to impact all countries in a similar manner. These arguments have triggered the interest of convergence and integration of economic indicators. Chou (2006) also argued that, the presence of convergence suggests that laggard regions are catching up with the economically better performing regions in terms of per capita GDP while the lack of convergence indicates a need for the creation and implementation of alternative regional policies. Jayaraman et al. (2007) conducted a convergence test to determine possible adoption of a single currency in the Asia-pacific region and found no evidence to support the region's candidature for monetary union. Alagidede, Tweneboah and Adam (2008)[4] examined the exchange rate and price convergence, otherwise known as validity of purchasing power parity (PPP) using quarterly data for the period 1974:1-2007:1 within WAMZ and found real exchange rates in The Gambia, Ghana, Nigeria and Sierra Leone to follow a random walk; and showed that nominal exchange rates and nominal prices adjust at different speeds to achieve long-run PPP, with the former adjusting faster than the latter. Jones (2002) has shown that though speed of convergence in per capita GDP has been, there has been evidence of per capita GDP convergence in the Economic Community of West African State (ECOWAS) within the period 1960-1990. These previous studies employed static estimators and treated convergence as an event but convergence is a process. In addition, no information with regards to whether the zone can ever converge or not and if so, when were provided.

The present study investigates two important components of the convergence issue, i.e., inflation and exchange rate convergence. Given the vulnerability of WAMZ countries to external shocks and years of experience of volatile inflation and exchange rate across the zone, inflation and exchange rate issues debatably the most critical facing the region as they move toward monetary integration. This is evidenced by the convergence criteria set by the WAMZ and the continual reschedule of the common currency introduction due to the inability of the candidate countries to meet the single digit inflation. We depart from previous convergence studies within the zone by employing time varying OLS which allows dynamic structural change. In addition, it goes beyond computing half-life to predict distance to convergence.

This paper empirically test the convergence of exchange and inflation rate of the member countries of WAMZ from first month of 1990 to the fifth month of 2010 using the model developed by Hall, Robertson and Wickens (1992). Our results find little support and evidence of convergence for exchange and inflation rates respectively, given support to non-readiness of WAMZ to the adoption of the single currency.

The rest of the paper is organized as follows: section 2 outlines the method used; section 3 presents data source and properties, section 4; empirical results and discussion; and section 5 ends with the conclusion.

2. METHODOLOGY

According to Hall, Robertson and Wickens (1992), convergence is concerned with relative long-run behaviour of a number of time series as economic time series data are generally non-stationary, for convergence, differences between the series do not drift indefinitely far apart. They observed that conintegration of non-stationary time series is necessary but not sufficient for convergence and therefore defined economic convergence between two series as the approximation to a constant of the difference between the series. According to Hall et al (1992) definition, X and Y have converged if $b = 0$ and convergence between Y and Z if $b = 1$ in the model

$$(\ln X_t - \ln Y_t) = a + b(\ln X_t - \ln Z_t) + u_t \quad (1)$$

[4] See the study for economic fundamentals of WAMZ

However since convergence is a gradual and ongoing process, static models such as equation (1) will subsumes structural stability and will certainly reject convergence if X and Y are still in the process of converging. Haldane and Hall (1991) and Hall and Wickens (1992) proposed the use of stochastically varying coefficients that allows for dynamic structural change to model unobserved deterministic or stochastic causes of parameter changes. This allows the data to reveal shifts or the transitional dynamics in the estimated relationship (Datta, 2003).

Hence we follow Hall *et al*. (1992), Haldane &Hall (1991), Kendall (2000) and Jayaraman, Ward and Xu (2007) by formulating the following model with time varying parameters:

$$(\ln Y_{REF} - \ln Y_{WAMZ}) = a(t) + b(t)(\ln Y_{REF} - \ln Y_{US}) + u(t) \quad (2)$$

Where Y_{REF}, Y_{WAMZ} and Y_{US} represent the nominal exchange and inflation rates of the

reference country, the US and individual WAMZ countries (Ghana, The Gambia, Nigeria and Sirra Leone) respectivery

To obtain estimates of a(t) and b(t) in equation (2), we formulate the following *state space model*s :

$$(\ln Y_{REF} - \ln Y_{WAMZ}) = a(t) + b(t)(\ln Y_{REF} - \ln Y_{US}) + u(t) \quad (3)$$

$$a(t) = a(t)_{-1} + V_{1t} \quad (4)$$

$$b(t) = b(t)_{-1} + V_{2t} \quad (5)$$

For each of the two variables, equation (3) represents the measurement or observation equation whereas equations (4) and (5) are the state or transition equations respectively. As usual $u(t)$, v_{1t} and v_{2t} are assumed normally distributed error terms with zero mean and constant variance. The error terms are also assumed both serially uncorrelated and independent of each other.

Hall *et al.* (1992) showed that $b(t)$ would tend to zero in the limit if the Y_{REF} and Y_{WAMZ} have converged. Alternatively, if Y_{WAMZ} and Y_{US} have converged, this parameter would tend towards one. However, the convergence of $b(t)$ to zero is considered a necessary but not sufficient condition for convergence between Y_{REF} and Y_{WAMZ}, instead both $a(t)$ must tend to a constant and $b(t)$ must tend towards zero. We estimate the parameter using the Kalman filter.

3. DATA SOURCE AND PROPERTIES

The empirical analysis is conducted using monthly time series data from the first month of 1990 to fifth month of 2010. Inflation is measured by the natural logarithm of the consumer price index; the nominal exchange rates are SDR units per unit of the currency of the country concerned. The exchange rate of national currencies with the SDR is determined by the daily market rates of the basket of currencies translated into US dollar amounts (US dollar: SDR exchange rate) and subsequently converted into the national currency at the exchange rate of the US dollar to the national currency. The US dollar and inflation are used because is the mostly used foreign currency and major development partner in the Zone. All the data are obtained from the International Financial Statistics of the IMF (IFS, 2010 online edition). Inflation rate of Guinea and Liberia are not considered in this study due to lack of data. Tables 1 and 2 present the descriptive statistics of inflation and exchange rates of the countries under consideration. The Tables report means, standard deviations, skewness and Jarque-Bera statistics of exchange rate and inflation of countries in the WAMZ. Tables 1 and 2 respectively show that the null hypothesis of normality of exchange and inflation rate of all the countries cannot be accepted. Table 1 show that all but Gambia's exchange rate are

negatively skewed. It is also clear that Ghana's exchange rate has been more volatile over the period of study than the rest. A cursory glance at Table 2 shows that with the exception of Ghana, the inflation rates of all the countries considered are negatively skewed. Contrary to the exchange rate, Ghana's inflation compared to the rest of the countries in the Zone looks more stable from 1990 to 2010.

Table 1: Descriptive Statistics of WAMZ Exchange Rates

	GA	GB	GH	LB	NG	SL
Mean	3.042383	6.184371	-0.870808	2.738458	4.275646	7.524217
Median	2.778000	6.634000	-0.717500	4.035000	4.878000	7.779000
Std. Dev.	0.512105	0.863464	1.251232	1.967726	1.017128	0.888225
Skewness	0.358923	-1.564024	-0.436116	-0.379163	-0.383950	-0.868859
Kurtosis	1.426121	4.249753	1.819360	1.180763	1.577262	2.987649
Jarque-Bera	29.92401	113.4657	21.54700	38.84680	26.13854	30.19818
Probability	0.000000	0.000000	0.000021	0.000000	0.000002	0.000000
Observations	240	240	240	240	240	240

GA-Gambia, GN-Guinea, Gh-Ghana, LB-Liberia, NG-Nigeria, SL-Sierra Leone

Table 2: Descriptive Statistics WAMZ Inflation rate

	GA	GH	NG	SL
Mean	1.483460	2.998730	2.681429	2.820560
Median	1.658445	2.977996	2.642010	2.718601
Std. Dev.	1.115656	0.535671	1.013114	1.174623
Skewness	-1.808116	0.427700	-0.630710	-0.823210
Kurtosis	7.971739	2.521917	4.630728	6.126679
Jarque-Bera	322.8351	8.202325	36.30596	106.6583
Probability	0.000000	0.016553	0.000000	0.000000
Observations	205	205	205	205

GA-Gambia, Gh-Ghana, NG-Nigeria, SL-Sierra Leone

4. EMPIRICAL RESULTS AND DISCUSSION

4.1 Convergence Test

As indicated earlier, cointegration of variables is a necessary condition for convergence so we first test for integrations and cointegration. The Augmented Dickey Fuller (ADF) unit root test for integration was employed. The results of ADF tests for integration of inflation and exchange rates are presented in Tables 3 and 4 respectively. The augmenting lag lengths of each variable were selected with Schwarz information criterion with maximum length of 10 lags. With the exception of exchange rate of Liberia, the levels and first difference tests the ADF equation with no trend and intercept.

The results obtained in Eviews 6S indicate that all the variables (exchange and inflation rates of all countries) are integrated to order (i.e. I (1)). We further conducted cointegration test and presented them in Tables 5 and 6. Table 5 shows the trace and maximum-Eigen test statistics of inflation among the WAMZ countries while Table 6 gives that of exchange rates. Both give support to the existence of cointegration among the variables. This suggests that the countries may be more readily candidates for monetary union, given that cointegration is a necessary but not sufficient condition for convergence.

4.1.1 Unit Root Tests

Table 3: Log of Inflation

	Levels		1st Difference	
	ADF Statistic	P-Value	ADF Statistic	P-Value
GA	-1.3262	0.6175	-10.0703	0.0000
GH	-0.7225	0.4028	-6.9565	0.0000
NG	-1.1831	0.2160	-17.9140	0.0000
SL	-1.4390	0.1397	-7.5957	0.0000

Table 4: Log of Exchange Rate (SDR)

	Levels		1st Difference	
	ADF Statistic	P-Value	ADF Statistic	P-Value
GA	2.453077	0.9968	-12.39418	0.0000
GH	-2.231777	0.1957	-7.272185	0.0000
NG	-1.519497	0.5222	-15.15192	0.0000
SL	2.866145	0.9990	-7.623492	0.0000
LB	-1.2650	0.6461	-17.9756	0.000
GN	1.862367	0.9851	-4.948342	0.0000

4.1.2 Cointegration Tests

Table 5: Log of Inflation Rate

H_0: r	Trace Statistics	0.05 Critical values	Max-Eigen Statistics	0.05 Critical values
None	51.34998**	47.85613	31.84034**	27.58434
At most 1	19.50964	29.79707	13.57099	21.13162
At most 2	5.938648	15.49471	5.116217	14.26460
At most 3	0.822431	3.841466	0.822431	3.841466

** denoted rejection of no cointegration at the 0.05 level

Table 6: Log of Exchange Rate

H_0: r	Trace Statistics	0.05 Critical values	Max-Eigen Statistics	0.05 Critical values
None	131.7884**	95.75366	47.81679**	40.07757
At most 1	83.97165**	69.81889	30.56488	33.87687
At most 2	53.40676**	47.85613	24.85651	27.58434
At most 3	28.55025	29.79707	17.56919	21.13162
At most 4	10.98106	15.49471	9.163496	14.26460
At most 5	1.817564	3.841466	1.817564	3.841466

** denotes rejection of no cointegration at the 0.05 level

However, we try to confirm this by estimating a Kalman Filter model for each series, again using EViews 6 software. For each country, the relevant estimates of the varying parameters for the SDR and inflation equations with Nigeria as reference country are displayed visually in chart form in Figures 1–8. The numerical results are not reported in order to save space, but available on request.

According to Figures 1, 3, 5 and 7, there seems to be an emerging convergence in nominal exchange rates (SDR per units of national currencies). This is especially so with regard to those of Gambia, Sierra Leone and Ghana. However, Liberia and Guinea show no and little indication of convergence respectively.

The case of Liberia is of no surprise because it joined the WAMZ in the second quarter of 2010. The disconnection of exchange rate of Guinea to that of Ghana, The Gambia, Sierra Leone and Nigeria may be link to colonial experience of these countries and were once members of the West African Currency Board.

The b(t) parameters of inflation rates of The Gambia, Ghana and Sierra Leone shown in Figures 2,4 and 6 respectively indicate no convergence at all. The degree of convergence in the inflation gives support to the non-readiness of the WAMZ for the common currency and that the decision to postpone its introduction is fit.

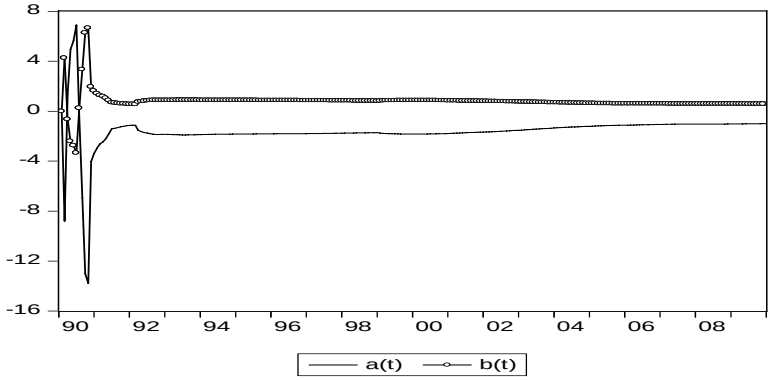

Figure 1: Exchange Rate- The Gambia

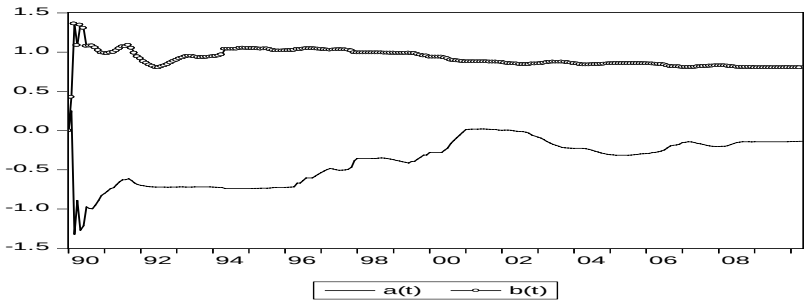

Figure 2: Inflation Rate - The Gambia

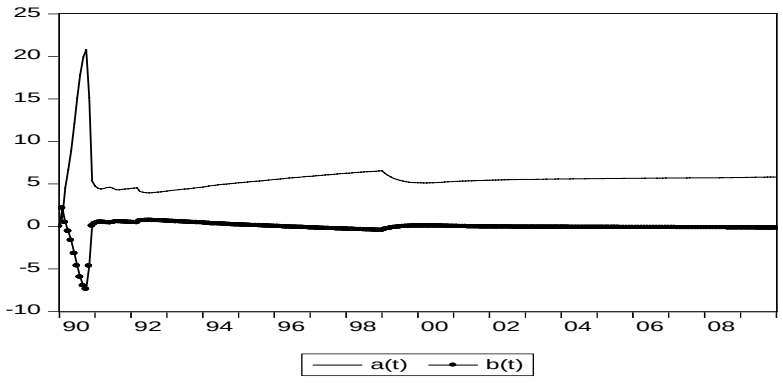

Figure 3: Exchange Rate-Ghana

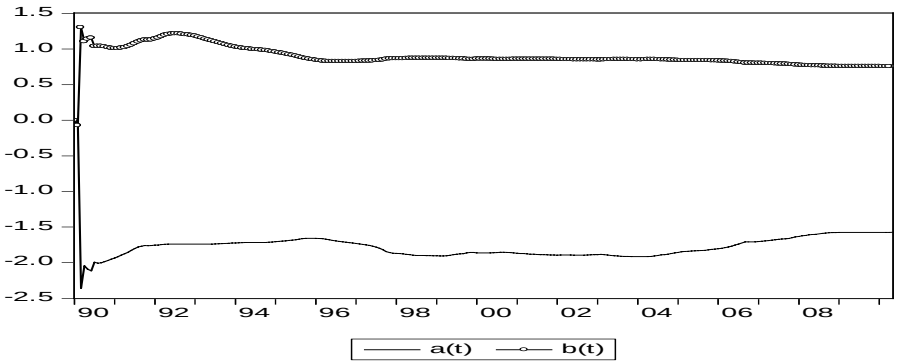

Figure 4: Inflation Rate-Ghana

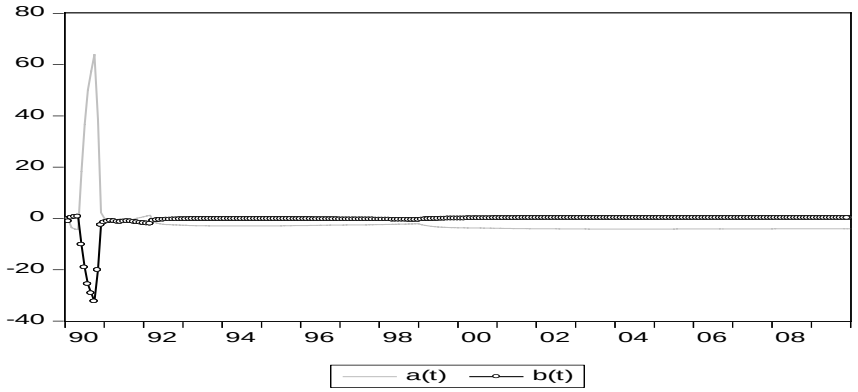

Figure 5: Exchange Rate-Sierra Leone

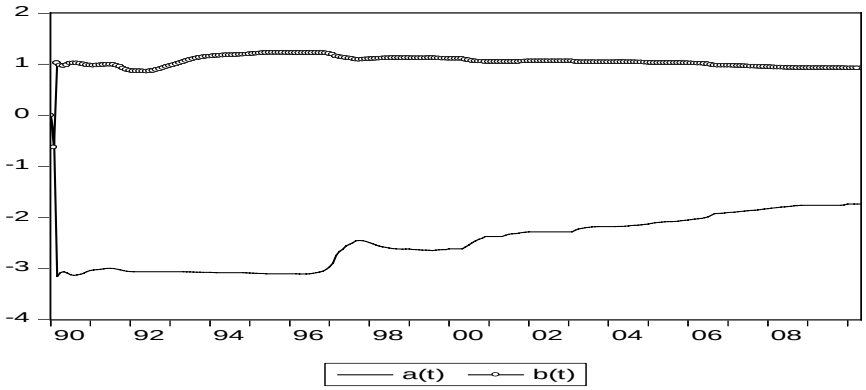

Figure 6: Inflation Rate-Sierra Leone

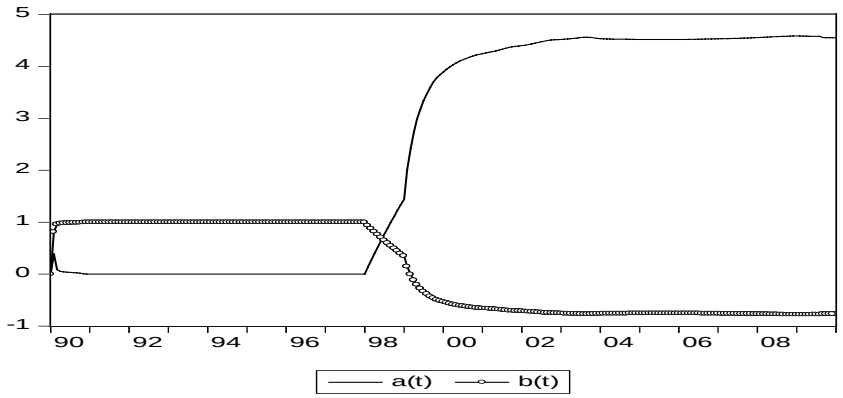

Figure 7: Exchange Rate-Liberia

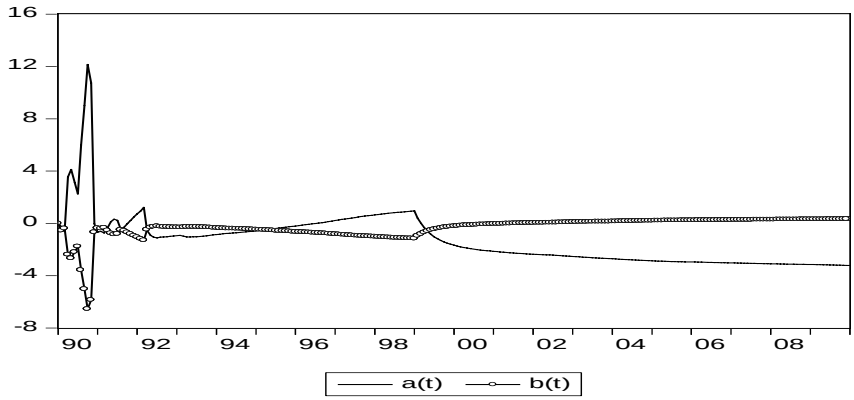

Figure 8: Exchange Rate-Guinea

4.2 Distance to Convergence

Can exchange and inflation rates in the West Africa Monetary Zone absolutely converge? If yes, When? We try to answer these questions by estimating the average convergence rate β since the formation of the WAMZ, recognising the structural changes as a result of the formation of the WAMZ as $\beta = \dfrac{\sum_{t=1}^{T}\left[\ln b(t-1) - \ln b(t)\right]}{T}$ and compute the time required for half of the final state of the varying parameter $b(t)$ to decompose (i.e. half-life) from $b(t)_f\, e^{-\beta\tau} = \frac{1}{2} b(t)_f$, where τ is the half-life and $b(t)_f$ is the final state of the varying parameter $b(t)$

The distance to convergence, d_t can then be estimated as $d_t = 2\tau$. Tables 7 and 8 respectively show the rate of convergence and distance to convergence of exchange rate and inflation. The results indicate slow rate of convergence and therefore higher distance to convergence in exchange and inflation rates especially in inflation rates. For example, it will take 3, 19 and 95 years for Ghana, Sierra Leone and The Gambia respectively to catch-up with the reference country, Nigeria, while inflation will take 262, 197 and 130 years, *Ceteris Paribus.* Liberia and Guinea were excluded because of evidence of divergence in both exchange and inflation rates. It is evident from the results that if no remedial policy is taken by the various economies, the zone will not be fully ready for a common currency if exchange and inflation rates matter.

Table 7: Rate of Convergence and Distance to convergence of Exchange rate

Country	Convergence rate (%)		Distance to Convergence	
	Per Month	Per Year	In Month(s)	In Year(s)
Ghana	8.24	98.88	35	3
Sierra Leone	1.3	15.6	227.76	19
Gambia	0.35	4.2	1129	95
Guinea	-	-	-	-
Liberia	-	-	-	-

Table 8: Rate of Convergence and Distance to convergence of Inflation

Country	Convergence rate (%)		Distance to Convergence	
	Per Month	Per Year	In Month(s)	In Year(s)
Ghana	0.138	1.65	3133	262
Sierra Leone	0.192	2.304	2358	197
Gambia	0.2813	3.372	1559	130
Guinea	-	-	-	-
Liberia	-	-	-	-

5. CONCLUSION

The success of currency union hinges on the fulfilment of a number of conditions necessary for policy coordination known as Optimum Currency Area/ Region (OCA/R) propounded by Mundel (1961). It requires existence of intra-regional trade prior to adoption of single currency amongst prospective members, high degree of mobility within the union, wage and price flexibility coupled with fiscal transfers to mitigate the impact of asymmetric shocks hitting the diverse economies (Jayaraman, Ward & Xu ,2007). Convergences of macroeconomic indicators such as exchange rate, interest rate and inflation rate are likely to minimise the adverse impact of shocks in the individual economies. A high degree of convergence of key macroeconomic indicators would render the aspiring region suitable candidate for currency union. If there is no convergence in any key indicators, a common set of policies would prove disastrous.

The results from the study found emerging convergence in exchange rates of four of the candidate countries (Ghana, Nigeria, Sierra Leone and The Gambia) but high distance to convergence and divergence in Guinea and Liberia. We also found a high degree of divergence and distance to convergence amongst inflation rates in the Zone. Thus, we found no reason to support readiness of West Africa Monetary Zone for any currency union. And that the decision of the countries to postpone the introduction of the single currency to 2015 is supported by this study. The study recommends that if no remedial/interventional policy is taken, the 2015 deadline could not be met.

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