**WEST AFRICAN MONETARY INSTITUTE**

**INSTITUT MONETAIRE DE L'AFRIQUE DE L'OUEST**

# OPTIMUM CURRENCY AREA INDEX FOR THE ECONOMIC COMMUNITY OF WEST AFRICAN STATES (ECOWAS)

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**Abstract**

*This study assesses the speed of real convergence in ECOWAS using the Optimal Currency Area (OCA) theory to determine the readiness of member countries for a monetary union. The study leveraged on Bayoumi and Eichengreen (1996) and computed OCA indices utilizing both variables suggested by the traditional OCA criteria and the new variables identified in the literature. Empirical results from the analysis showed that ECOWAS countries could be divided into three groups: those exhibiting high level of real convergence and would be ready to join the monetary union at the proposed date of 2020, those exhibiting medium level of convergence and may be ready for the union shortly after 2020, and those converging slowly and would require more time to achieve convergence. Additional results indicated that UEMOA countries have achieved real convergence and the single currency programme benefitted the countries at least in line with the OCA analysis. The results also showed that small countries stand to benefit most from joining a monetary union than having its own currency. The study recommends that the formation of an ECOWAS monetary union should assume a gradual approach. In the interim, however, WAMZ countries should intensify efforts to meet the ECOWAS nominal macroeconomic convergence criteria on a sustained basis, as this would make the countries move faster towards real convergence.*

**Keywords:** Optimum Currency Area, real convergence, Business cycle asymmetry, trade linkages, ECOWAS.
**JEL Classification:** C33, C43, F15, O55

# 1.0 INTRODUCTION

Most countries of the world are currently into one form of monetary union or the other, inspired by the need for political and economic stability, and to facilitate their transformation into a truly unified market which would reduce transaction costs on trade and investment, and invariably, impact positively on economic prosperity of the entire bloc. Accession of countries into a monetary union, however, is not without costs. The cost is derived from the fact that when a country opts for a monetary union, it relinquishes its monetary policy independence. The critical question, therefore is: whether joining a monetary union is a worthwhile venture when compared to the cost of relinquishing vital instruments? The resolution of this crucial issue is provided in the theory of Optimum Currency Area (OCA), propounded by Mundell (1961) and others. The theory proposes that these countries must exhibit a number of pre-conditions. These include perfect mobility of factors of production, particularly labor and capital; wages and price flexibility; trade integration; financial integration; low and stable inflation; diversification of their economic activities; among others. To achieve these pre-conditions, member countries set up a number of macroeconomic convergence criteria to be fulfilled in the proposed monetary zones - the notable one being the Maastricht criteria, which serve as the linchpin of monetary integration across the world. Based on the main conclusions from Mundell (1961) and others, a currency area is adjudged optimum if the benefits accruing to member states exceed the costs.

Owing to the need to ensure greater stability, stronger economic ties and prosperity among the West African countries, the Economic Community of West African States (ECOWAS) was established in May 1975 by fifteen West African countries[1]. In order to achieve full economic integration and introduce a single regional currency, the Community adopted the ECOWAS Monetary Cooperation Programme (EMCP) aimed at harmonizing the national monetary systems of member countries and creating a stable macroeconomic environment conducive to the introduction of the regional currency. Macroeconomic convergence criteria were, therefore, developed and were to be fulfilled by all member countries prior to the formal take-off of the union. There are, however, concerns about the possibility of an enduring monetary union among ECOWAS countries, which is heightened by some challenges faced in the Euro zone. Given the euro zone experience, there are general concerns about the readiness of West African countries to forge a common monetary union. The major concern centers on the vulnerabilities of countries to external shocks, differences in economic structures, and the need for synchronization of an existing monetary union with a prospective one, among others.

In the light of these concerns and related issues, the performance of ECOWAS countries on the convergence criteria has been researched extensively in both policy and academic environments. However, few studies have assessed the feasibility of deriving benefits from joining a monetary union in ECOWAS, particularly in line with

[1] Benin, Burkina Faso, Cote d'Ivoire, Gambia (The), Ghana, Guinea, Guinea-Bissau, Liberia, Mali, Mauritania, Niger, Nigeria, Senegal, Sierra Leone and Togo. Cape Verde joined in 1976 while Mauritania left in 2000.

the criteria stated in the OCA theory. Bayoumi and Eichengreen (1996) operationalized the OCA theory focusing on industrial countries. Benassy-Quere and Coupet (2005), however, assessed the rationale for monetary unions in sub-Saharan Africa utilizing cluster analysis which has intensive data requirements. Cham (2009) conducted an assessment on West African Monetary Zone (WAMZ) member countries using both nominal macroeconomic convergence and the traditional OCA criteria including openness, diversification and labour mobility. Debrum et al (2002, 2005) dwelt more on the fiscal performance and its effect on the monetary integration process in ECOWAS while Harvey and Cushing (2015) assessed whether WAMZ countries have common sources of shocks.

Following the work of Bayoumi and Eichengreen (1996), this study computes OCA indices for ECOWAS countries and extended the model by including additional variables identified in the literature. These include trade openness, inflation differentials, financial development and a dummy variable to control for participation in an already existing monetary union (UEMOA - Union Economique et Monétaire Ouest Africaine). The main aim is to examine the feasibility of a monetary union among ECOWAS countries and empirically assess the speed of real convergence in ECOWAS using the OCA theory. This will hopefully shed more light on the readiness of ECOWAS countries to form a monetary union. It is expected that the outcome of the study would provide additional guidance to policy makers in the region, and ultimately, facilitate the process of monetary integration.

The remainder of this study is structured as follows; section two examines the theoretical and empirical literature while section three explains the data and methodological framework. Section four discusses the findings and section five concludes the study.

# 2.0 THEORETICAL AND EMPIRICAL LITERATURE

## 2.1 Theory and Empirical Regularity of Optimum Currency Area (OCA)

The OCA generally serves as the workhorse for analyzing the viability of a monetary union particularly since the seminal paper by Mundell (1961). Based on the work of Mundell (1961), an optimum currency area is a group of countries in which it is economically viable to maintain a single currency instead of multiple currencies. He recognizes three main criteria for group of countries to qualify as OCA. These criteria are symmetric shocks, perfect mobility of labor, and transaction value of a single currency. Mobility of labor is considered as a dominant channel through which imbalances arising from asymmetric shocks could be corrected. For instance, if there is an adverse shock to output in a member country, the surplus labor arising from such development would migrate to another member country, and therefore leads to moderation in wages and demand for labor in the recipient country. The process would continue until marginal productivity of labor is equalized in both countries. As such, a common monetary or fiscal policy could be deployed to stimulate output in these countries.

In reality, however, these conditions rarely hold particularly in developing and emerging economies such as the WAMZ. In the light of this, it is difficult to resolve the challenge of asymmetric shocks as proposed by Mundell (1961). Thus, the initial criteria has been refined by several authors to conform to the dynamic nature of the macroeconomic environment. As part of the refinement process, Kenen (1969) indicated that a well-diversified economy is a better candidate for a currency union than a less-diversified one, as frequent adjustments in exchange rates on account of adverse shocks to output would be minimized in a well-diversified economy than in one with a narrow range of products. He further stresses that the resilience of a highly-diversified economy could be strengthened by a regime of flexible prices and wages in member countries.

Extending the analysis further, Bayoumi and Ostry (1997), and Jonung and Sjoholm (1998) argue that similarity in industrial structures could enhance the prospects of forming a monetary union. This is because such group of countries have a high likelihood of being affected by similar sector-specific shocks and therefore obviate the need for implementing a unilateral adjustment in the exchange rate on account of terms of trade shocks. They equally recognized that countries with diverging economic structures but with a high degree of co-movement in economic activities could be better candidates for a monetary union since they are most likely going to be confronted with similar shocks and invariably reduce the need for exchange rate adjustment as a vehicle for managing the shock. Tavlas (1993) identifies another important criterion, which is political factor. The argument in support of this factor, however, is largely based on the experience from the European Union and has not been given support from other jurisdictions.

## 2.2 Empirical Literature

A number of studies have empirically investigated the compliance of member states in a monetary union with the OCA criteria. Among the pioneer empirical works, Bayoumi and Eichengreen (1996) operationalize the OCA theory by analyzing the determinants of nominal exchange rate

variability for 21 industrial countries. The study identified five important criteria which make exchange rates stable and monetary unification desirable - asymmetric disturbances to output, trade linkages, usefulness of money for transactions, mobility of labour and the extent of automatic stabilizers. They measure output disturbances using both standard deviation of the change in the logarithms of relative output and the dissimilarity of the commodity composition of the exports of the two countries. Trade linkages was measured using bilateral trade data while the arithmetic average of real GDP of the two countries was used to measure country size. Utilizing Germany as the base country, the study showed that European countries were divided into three groups – those exhibiting high level of readiness to join the EMU, those that have the tendency to converge and those in which little or no convergence is evident. They also found that economic integration increases a country's readiness for monetary integration, as countries among whom the completion of a single market has led to the greatest increase in bilateral trade have experienced the greatest increase in their readiness for monetary integration according to their OCA index. Bayoumi and Eichengreen (1998) also proved that the variables pointed by the OCA theory help in explaining the behavior of bilateral exchange rates and, thus, exhibit considerable explanatory power. They further found that asymmetric shocks increase exchange rate volatility by intensifying exchange market pressure, while small size and trade links reduce volatility by encouraging intervention.

Some studies adopted the Bayoumi and Eichengreen (1996) methodology to assess countries' readiness to form an OCA. Cincibuch and Vavra (2000) investigated the structural similarity in the economies of Czech Republic and the EU, focusing mainly on the 1990s. They showed that there was a tendency for Czech Republic to converge with the EU particularly between the first and second halves of the decade. Horvath and Kucerova (2005) equally adopted the Bayoumi and Eichengreen (1996) approach and the generalized method-of-moment (GMM) methodology to address endogeneity bias inherent in the OLS estimates. In addition to the traditional OCA criteria in Bayoumi and Eichengreen (1996), the study also considered the level of financial development, variability of the US dollar exchange rate and a dummy variable for participation in an exchange rate mechanism (ERM). Their results showed that these factors significantly explain the variability of real exchange rates. Hedija (2011) also found similar results as Bayoumi and Eichengreen (1996) for the EU during 1999 – 2009.

Skofekpa (2011, 2013) modified the Bayoumi and Eichengreen (1996) model by making the OCA index sensitive to real convergence using the mean absolute value of the exchange rates as the endogenous variable instead of the standard deviation in nominal exchange rate employed in other studies. The exogenous variables, on the other hand, were symmetry of business shocks, dissimilarity of export structures and mutual trade linkages. The results indicated that while some Eastern European economies were far from converging with Germany, two Central European economies were better prepared for a common currency with Germany than even some of the current EU members. Frydrych and Burian (2017) evaluated convergence in the European Monetary Union using data for the period 2001-2013 by computing an OCA index. The computed indices were relatively stable during the period of study but the values of the index did not decrease over time, suggesting that the countries were not converging. Against this perspective, the authors concluded that the convergence

process was not proven before the EU commenced its monetary union.

Other studies, however, employed different approaches to assess the optimality of a currency area within a zone. For instance, Hovanov, Kolari and Sokolov (2002), using an optimization framework, computed an Invariant Currency Value Index (ICVI). The authors showed that the index has many applications including for the determination of the optimal weights for currencies during the formation of a monetary union. Artis and Zhang (2001), employed a cluster analysis to examine the similarities and dissimilarities of economic structure as proxies for OCA criteria. Their results revealed that some groups of countries have similar economic structure and could therefore be classified as the core groups that that are suitable for monetary union. One of the striking features of the result is that the core group revolve around Germany. Benassy-Quere and Coupet (2005) equally employed cluster analysis to examine the rationale for monetary unions Sub-Saharan Africa utilizing variables from the OCA theory. Their findings support the inclusion of The Gambia, Ghana and Sierra Leone in an expanded UEMOA arrangement. The major advantage of this methodology is that it incorporates more variables than most of the other models but it is highly complicated and requires detailed economic data. The intensive data requirement could have probably informed the poor result obtained on African countries. Bah (2015), following Carrion-i-Sivestre et al. (2005) panel stationary test, assessed the level of real convergence in WAEMU. The author found, when considering structural breaks, the existence of stochastic convergence for five (out of the eight) WAEMU countries.

Debrun et al (2002) argued that differences in government spending propensities were more important than asymmetric shocks in determining net gains and losses from potential monetary unions. The study found that UEMOA member countries would not obtain maximum benefits from participating in the ECOWAS monetary union owing to the high fiscal distortions from the biggest country in the union – Nigeria, which would tend to put pressure on the union's central bank to manage those distortions and the attendant high inflation. Debrun et al (2005) further indicated that fiscal heterogeneity is very critical to a regional currency union that would be mutually beneficial for its members. They added that Nigeria's membership of ECOWAS would be less beneficial to other member countries unless its financing needs (fiscal) are contained effectively.

Cham (2009) assessed the feasibility of West African Monetary Zone (WAMZ) in forming a monetary union from the view point of compliance with the OCA criteria. He employed the same criteria that were used in the European Monetary Union as well as a comparison with the West African Economic and Monetary Union (WAEMU). The analysis was premised on the three criteria of the OCA namely openness, synchronization of shocks, and labor mobility while the results showed that the zone performed well only on openness. However, labour mobility was low and shocks were not uniform across the zone. On this basis, the study concluded that the zone failed to meet the OCA criteria. Corroborating Cham (2009), Harvey and Cushing (2015) found that the WAMZ countries did not have common sources of shocks due to differing economic structures and, hence, respond asymmetrically to common supply, demand and monetary shocks and would respond differently to a common monetary policy. The study concluded that it would be less beneficial for the countries to go into a monetary union unless member countries' economies converge further. Balogun (2007), however, showed that the WAMZ countries would be

better off in surrendering their independence over some policy instruments to an appropriate monetary union arrangement.

In the light of the various studies surveyed therefore, the compliance of monetary union member countries with the OCA theory and their movement towards convergence have remained a subject of contention. Most studies above tested this compliance using the traditional OCA criteria. However, the dynamism in macroeconomic environments indicate the need to include additional criteria to be met by countries prior to joining a monetary union. This study assesses the feasibility of ECOWAS monetary union utilizing both the traditional OCA criteria and other variables identified in the recent literature. The key approach to doing this is by analyzing the determinants of bilateral exchange rate variability.

## 3.0 DATA AND METHODOLOGICAL FRAMEWORK

### 3.1. Data

Data used in this study were obtained from three major macroeconomic data providers. The nominal exchange rates utilized in computing the bilateral real exchange rate variability as well as credit to private sector as a percent of GDP were obtained from the World Development Indicators (WDI) database. Data on real and nominal GDP, and CPI, including projections up to 2022, were obtained from the World Economic Outlook (WEO) database of the International Monetary Fund (IMF) while international trade data were obtained from ECOWAS and country authorities. Projections for trade and credit to private sector data for the period 2017 – 2022 were obtained using econometric procedures.

The OCA index is computed using annual data set for the fifteen (15) ECOWAS countries for the period 2010 – 2016, and projections for the OCA index were made up to 2022. The sample size is chosen for two reasons; to avoid the impact of the global financial crisis which occurred between 2007 and 2008 and the fact that data for Liberia were only available from 2010. The study came up with 210 pairs of two countries each. Thus, the study utilizes 1,470 observations given that each country pair has 7 observations (2010 – 2016).

### 3.2 The Model

Empirical estimation of optimum currency area (OCA) index to validate the theory of OCA was pioneered by Bayoumi and Eichengreen (1996). The OCA index seeks to establish the symbiotic relationship between monetary and economic integration, suggesting that in an area where single market led to a significant increase in bilateral trade, there is a significant increase in the readiness for a monetary union. Conversely, where monetary integration has deepened economic integration, there is evidence of a stable exchange rate or limited exchange rate variability supporting trade. More generally, when the real exchange rate between two countries is stable, it gives an indication that there were not many asymmetric shocks between the two countries that require real exchange rate changes (Gros and Hobza, 2003).

The original model specified by Bayoumi and Eichengreen (1996) is as follows:

$$SD(e_{ij}) = a + \beta_1 SD(\Delta y_i, \Delta y_j) + \beta_2 Dissim_{ij} + \beta_3 Trade_{ij} + \beta_4 Size_{ij} + \varepsilon_{ij} \quad (1)$$

where $SD(e_{ij})$ is the divergence or the variability in the bilateral exchange rates, measured as the standard deviation of the change in the logarithm of the end-year bilateral nominal exchange rate between country pair *i* and *j*. This could be interpreted as the cost to country *i* being in a monetary union with country *j*. Thus, the more the two countries satisfy the OCA conditions for a monetary union, the smaller the $SD(e_{ij})$, the deviation of the bilateral exchange rate of country $i$ from county $j$. Smaller $SD(e_{ij})$ means lower cost of being in a monetary union whilst large $SD(e_{ij})$ means higher benefit for leaving or not being in a monetary union. $SD(\Delta y_i, \Delta y_j)$ is the standard deviation of the difference in the logarithm of real output between countries i and j, $Dissim_{ij}$ is the sum of the absolute differences in the shares of agricultural, mineral and manufacturing trade in total merchandize trade, $Trade_{ij}$ is the mean of the ratio of bilateral exports to domestic GDP for the two

countries, and $Size_{ij}$ is the mean of the logarithm of GDP of the two countries measured in US dollars. While Bayoumi and Eichengreen (1996) used bilateral nominal exchange rate in their model, we estimate our model using bilateral real exchange rate in order to measure convergence in real terms. Another reason for choosing real exchange rate is the fact that our study includes the UEMAO countries which have a single currency and their nominal exchange rate is equal across all member countries. The variability in the bilateral real exchange rate is calculated as follows:

$$SD(e_{ij}) = stdev\left[d\left(\log(n_{ij}\frac{p^*}{p_j})\right)\right] \quad (2)$$

where $stdev$ stands for the standard deviation[2] of the change $(d)$ from year $t$ to $t+1$ in the logarithm of bilateral real exchange rate $(e_{ij})$ between countries $i$ and $j$; $n_{ij}$ is the bilateral nominal exchange rate, and $p_j$ and $p^*$ represent domestic and foreign price levels,[3] respectively.

In line with equation (1), $SD(e_{ij})$ is influenced by the asymmetry of business cycles between a pair of two countries $SD(\Delta y_i, \Delta y_j)$ which is measured as the standard deviation of the change in the logarithm of real output of country *i* and country *j*. The greater the deviation of short-run real output dynamics (business cycle) of country *i* from country *j*, the greater will be the variability or divergence of bilateral real exchange rate of country *i* from country *j*. Thus, the coefficient of $SD(\Delta y_i, \Delta y_j)$, is expected to be positive (β1>0).

Dissimilarities or differences in trade or export structure between two countries captured as $Dissim_{ij}$, also influences $SD(e_{ij})$. $Dissim_{ij}$ determines the degree of asymmetry in external shocks faced by the two countries. The greater the degree of asymmetry in external shocks faced by the two countries, the greater the deviation of exchange rate variability between countries *i* and *j*. Conversely, the lower the degree of asymmetry or the more the similarities in external shocks faced by the two countries, the smaller the variability in their exchange rate movements. $Dissim_{ij}$ is computed as the sum of the absolute differences in the share of each tradable sector of the two countries. Given that the tradable or total merchandize trade (*T*) of the countries can be categorized into agricultural (*A*), Mineral (*MIN*) and manufacturing (*MNT*) based on their relative vulnerability to external shocks, the $Dissim_{ij}$ can be computed as follows:

$$Dissim_{ij} = \left(\frac{A_i}{T_i} - \frac{A_j}{T_j}\right) + \left(\frac{MNT_i}{T_i} - \frac{MNT_j}{T_j}\right) + \left(\frac{MIN_i}{T_i} - \frac{MIN_j}{T_j}\right) \quad (3)$$

The coefficient of $Dissim_{ij}$ is expected to be positive $(\beta_2 > 0)$ indicating that the greater the asymmetric shocks faced by the two countries, the higher the cost of forming a monetary union by *i* and *j*. In addition, $SD(e_{ij})$ is also influenced by trade intensity or linkages between country *i* and country *j* captured as $Trade_{ij}$. It is measured as the arithmetic mean of the ratio of bilateral exports to domestic nominal GDP for the country pair.

$$Trade_{ij} = Mean\left(\frac{Exp_{ij}}{GDP_i}, \frac{Exp_{ji}}{GDP_j}\right) \quad (4)$$

[2] The sample standard deviation measure is used.

[3] Foreign price level is represented by the US Consumer Price index (CPI)

The coefficient of $Trade_{ij}$ is expected to be negative ($\beta_3 < 0$). $Exp_{ij}$ denotes total export from country $i$ to country $j$ while $Exp_{ji}$ is export from country *j* to country *i*. Hence, the greater the trade linkage between country $i$ and country $j$, the smaller the variability in bilateral exchange rate between the two countries $i$ and $j$.

$Size_{ij}$ represents the size of the economy and it evaluates the benefits of a big country maintaining or abandoning its own national currency. It is argued that the costs of a common currency, in terms of macroeconomic independence foregone, should be balanced against the benefits. The benefits of a common currency should, therefore, be greatest for small economies where there is least scope for utilizing a separate national currency in transactions. Thus, small countries should benefit the most from the unit of account, means of payment and store of value services provided by the common currency (Bayoumi and Eichengreen, 1996). As in the previous studies, we measure $Size_{ij}$ as the mean of the logarithm of the real GDP of the paired countries, $i$ and $j$ and its coefficient is expected to be positive ($\beta_4 > 0$).

In addition to the four (4) main determinants of bilateral exchange rate as stated in Bayoumi and Eichengreen (1996) in equation (1), Horvath and Kucerova (2005) identified other OCA criteria to include price and wage flexibility, financial development, similarities of inflation rates and a dummy to represent countries participating in an exchange rate mechanism (ERM), among others. Horvath and Komarec (2003) also considered openness (OPEN) as one of the OCA criteria, and thus, substituted SIZE with OPEN. Thus, we include four (4) more variables in our estimation namely openness, the level of financial development, inflation differential and a dummy variable for country pairs who are members of the UEMOA zone.

Consequently, our modified equation (1) is specified as follows:

$$SD(e_{ijt}) = \beta_0 + \mu_i + f_j + \beta_q' X_{ijt} + \beta_3 Open_{ijt} + \beta_4 Infdiff_{ijt} + \beta_5 Findev_{ijt} + \beta_6 Uemoadum_{ijt} + \varepsilon_{ijt} \quad (5)$$

where $\mu_i + f_j$ stand for the countries $i$ and $j$, respectively, specific fixed effects and $X_{ij}$ represents a vector of independent variables captured by Bayoumi and Eichengreen (1996) as stated in equation (1). However, we dropped the variable $Dissim_{ij}$ due to the inadequate data for exports by sectoral level for some ECOWAS countries. We also dropped $Size_{ij}$ and included $Open_{ij}$ in the model in line with Horvath and Komarec (2003). Thus, ($\beta_q = (\beta_1, \beta_2)$ and $X_{ijt} = [SD(\Delta y_i, \Delta y_j), Trade_{ij}]$.

$Open_{ij}$ represents the openness ratio which is one of the traditional OCA criteria. Horvath and Komarec (2003) indicated that the variable can be positive or negative. Thus $\beta_3$ can assume any value whether positive or negative. We compute $Open_{ij}$ as the arithmetic mean of the openness ratios of the two countries, with openness computed as the ratio of total trade to nominal GDP for the countries.

$Infdiff_{ij}$ represents inflation dissimilarities between countries $i$ and $j$ which also is a determinant of exchange rate variability. Large dissimilarities in inflation rates can result in a significant external imbalance that may induce exchange rate adjustment therefore, ($\beta_4 > 0$). We computed $Infdiff_{ij}$ as the standard deviation of the difference in the logarithm of the CPI of countries $i$ and $j$ as follow:

$$Infdiff_{ij} = stdev\left[d(\log(cpi_i), d\left(\log(cpi_j)\right)\right] \quad (6)$$

$Findev_{ij}$stands for the level of financial development of countries $i$ and $j$, and it is expected that high financial development linkage between country $i$ and country $j$ reduces the cost of being in a monetary union ($\beta_5 < 0$) as capital flows absorb external shocks. Credit to private sector as a percentage of GDP is used as a proxy for financial development between countries $i$ and $j$ and computed as follows:

$$Findev_{ij} = \frac{1}{2} * (b_i + b_j) \qquad (7)$$

Where $b$ stands for credit to private sector as percent of GDP of countries $i$ and $j$.

Finally, $Uemoadum_{ij}$ is a dummy variable meant to capture the impact of participation in the UEMOA zone. It takes the value 1 if both (paired) countries $i$ and $j$ belong to the UEMOA zone and 0 otherwise. It is expected that the participation of countries in an exchange rate mechanism decreases the volatility of the real exchange rate among members, hence, ($\beta_6 < 0$).

### 3.3 Estimation Technique

The paper employs panel econometric analysis to estimate equation 5. We opted for panel models to assess real convergence in ECOWAS to determine its readiness for a monetary union. Panel data provide larger observations which allows for more degrees of freedom and the ability to examine the individual differences of each of the ECOWAS countries. Panel data model is generally specified as follows:

$$Y_{it} = \beta_0 + \beta_q \mathrm{X}_{it} + \varepsilon_{it} \qquad (8)$$
$$i = 1 \dots \dots . . N, t = 1 \dots \dots , T$$

$Y_{it}$ and $\mathrm{X}_{it}$ are the dependent and the independent variables, respectively, while $\beta$s are the parameters to be estimated in the model, $\varepsilon_{it}$ is the error term. Ordinarily, equation 8 can be estimated with the Ordinary Least Squares (OLS) technique, but the result would be biased and inconsistent mainly due to the presence of heterogeneity of the individual countries. It, therefore, requires models that account for heterogeneity, hence the use of fixed or random effect models. The fixed effect (FE) is specified as:

$$Y_{it} = \beta_0 + \beta_q \mathrm{X}_{it} + \mu_i + \varepsilon_{it} \qquad (9)$$

$\mu_i$ represents the individual country specific effects.

On the other hand, the random effect (RE) is specified as:

$$Y_{it} = \beta_0 + \beta_q \mathrm{X}_{it} + \lambda_i + \upsilon_{it} \qquad (10)$$

$\lambda_i$ denotes the random effect and $\upsilon_{it}$ is the reminder of the error term.

We estimate the three (3) models above and find that the RE model is the most appropriate model for our study even though the Hausman test rejects the null hypothesis and indicated that the fixed effect is the most robust model. Indeed, the fixed effect estimator does not allow for the inclusion of time invariant variables thereby suppresses the dummy variable (*uemoadum*) included in our model. As mentioned above, the dummy variable is key in controlling for the impact of UEMOA countries' participation in the ECOWAS single currency programme given that they already have a single currency.

To compute our OCA index, we utilize the parameters of the random effect model along with the values of the independent variables for each period. The three models described in equations 8 – 10 are estimated and presented in Table 2.

## 4.0 DISCUSSION OF FINDINGS

This section presents the results of the analysis including the econometric model results and the computed OCA indices for the ECOWAS countries.

### 4.1 Summary Statistics

Table 1 present the summary statistics of the variables used in the model which have been transformed.

**Table 1: Summary Statistics**

| | (1) | (2) | (3) | (4) | (5) |
|---|---|---|---|---|---|
| VARIABLES | N | mean | sd | min | max |
| sdrer | 1,470 | 0.0447 | 0.0510 | 0 | 0.322 |
| sdy | 1,470 | 0.0578 | 0.0577 | 1.00e-04 | 0.310 |
| trade | 1,470 | 0.00275 | 0.00528 | 0 | 0.0618 |
| size | 1,470 | 8.554 | 1.075 | 6.459 | 11.63 |
| open | 1,470 | 0.662 | 0.314 | 0.238 | 2.107 |
| infdiff | 1,470 | 0.0364 | 0.0312 | 0 | 0.127 |
| findev | 1,470 | 20.66 | 9.458 | 5.311 | 50.93 |
| uemoadum | 1,470 | 0.267 | 0.442 | 0 | 1 |
| Number of crossid | 210 | 210 | 210 | 210 | 210 |

### 4.2 Model Results

The estimated results for the three models are presented in Table 2. Column 1 shows the result of the Panel OLS. The statistical significance and sign of some of the coefficients appeared satisfactory yet the result might be biased because the model assumes homogeneity of the individual countries hence cannot be relied upon. Similarly, the FE model results in column 2 exhibit some consistency by capturing the impact of variations from some of the explanatory variables, yet it does not allow for the inclusion of UEMOA dummy variable, which is a key distinguishing variable with respect to the membership or non-membership of an already existing currency union (UEMOA) and the likely impact this may have on the outcome of our analysis. In the light of the identified shortcomings of the Panel OLS and the FE models, we focus on analyzing only the results of the RE model in what follows.

Empirical results from the RE model in column 3 of table 2 indicate that the variability of output $SD(\Delta y_i, \Delta y_j)$ has a strong influence on real exchange rate variability. The coefficient was significant at the 1 percent level and carried the correct sign. This implies that a 1 percent rise in output variability would induce a 0.52 percent increase in real exchange rate variability. Consequently, cyclical fluctuations in output adversely affect real exchange rate movements. This is consistent

with the findings of Eichengreen and Bayoumi (1996) regarding the strong role of business cycles on the variability of exchange rate. Contrary to the expected negative sign, the *Trade* variable shows a statistically significant positive relationship with exchange rate variability. The result indicates that trade linkages among the ECOWAS countries tend to increase real exchange rate variability. This is probably on account of the low trade volumes among the countries and the constraint imposed by the use of a third currency, usually the US dollar, to settle bilateral trade transactions among them, because of the non-convertibility of their currencies. In a related study, Egbuna (2014) finds a statistically insignificant relationship between trade variable and exchange rate variability. The author, however, attributed this to the absence of trade relations between some of the countries.

**Table 2: Determinants of Real Exchange Rate Variation in ECOWAS Countries**

| VARIABLES | (1) OLS | (2) FE | (3) RE |
|---|---|---|---|
| sdy | 0.516*** | 0.518*** | 0.516*** |
| | (0.0178) | (0.0323) | (0.0296) |
| trade | 0.486*** | 0.212 | 0.486*** |
| | (0.175) | (0.297) | (0.181) |
| open | 0.00636** | 0.00284 | 0.00636** |
| | (0.00293) | (0.00293) | (0.00215) |
| infdiff | 0.186*** | 0.0358 | 0.186*** |
| | (0.0360) | (0.0621) | (0.0394) |
| findev | -0.000265*** | 0.00173*** | -0.000265*** |
| | (0.000100) | (0.000387) | (0.000101) |
| uemoadum | -0.0184*** | | -0.0184*** |
| | (0.00254) | | (0.00224) |
| Constant | 0.0129*** | -0.0248*** | 0.0129*** |
| | (0.00369) | (0.00652) | (0.00407) |
| Observations | 1,470 | 1,470 | 1,470 |
| R-squared | 0.535 | 0.401 | |
| Country effect | NO | YES | NO |
| year effect | NO | NO | NO |
| rmse | 0.0348 | 0.0323 | 0.0348 |
| F-test | 280.8 | 90.21 | |
| Prob > F | 0 | 0 | |
| Hausman | | | |
| Chi-Square | | 34.04*** | |
| Standard Error | | | 0.035 |
| Number of crossid | | 210 | 210 |

Standard errors in parentheses
*** p<0.01, ** p<0.05, * p<0.1

Also, trade openness (*Open*) was found to be positive and significant at the 5 percent level, indicating that higher trade openness tends to increase exchange rate variability in the countries during the period. The coefficient of inflation differentials (*Infdiff*) was positive as expected, and significant at the 1 percent level and revealed that a 1 percent increase in inflation differentials results in a 0.19 percent increase in real exchange rate variability. Thus, persistent differences in national inflation rates lead to bilateral exchange rate variability among the countries in the region. Horvath and Kucerova (2005) indicated that when inflation rates between countries are similar overtime, their terms of trade would also be stable. This would foster more equilibrated current account transactions and trade, and ultimately reduce the need for nominal exchange rate adjustments. Financial development (*FINDEV*) shows the expected negative sign and is statistically significant at the 1 percent level, confirming the inverse relationship between financial development ad exchange rate variability. The outcome indicates that high financial development tends to reduce exchange rate variability in ECOWAS countries. Similarly, the *UEMOA* dummy, which control for the impact of UEMOA countries participation in the ECOWAS single currency programme, is negative and significant at the 1 percent level. This implies that UEMOA member countries experience significantly lower exchange rate variability than their non-UEMOA counterparts. The result reveals that UEMOA members have moderate real exchange rate fluctuations than the WAMZ members. This result is consistent with our earlier emphasis that UEMOA countries already belong to a monetary union and have a single currency so would not experience considerable exchange rate variability among them.

### 4.3 OCA Indices for ECOWAS Countries

We now compute the OCA indices as the projected value of real exchange rate variability using the empirical results from the RE model. The lower the value of the OCA index, the higher the benefits of adopting a single currency and joining a currency union. Consequently, lower real exchange rate variability implies that the countries fulfil the OCA criteria. The OCA indices were derived using the equation below:

$$\begin{aligned} SD(e_{ijt}) = {} & 0.013 + 0.516 * SD(\Delta y_i, \Delta y_j) \\ & + 0.486 * Trade_{ij} \\ & + 0.0064 * Open_{ij} + 0.186 \\ & * Infdiff_{ij} - 0.0003 \\ & * Findev_{ij} - 0.018 \\ & * Uemoadum_{ij} \end{aligned} \quad (11)$$

The indices were computed for each ECOWAS Member State vis-à-vis other ECOWAS Member States for the period 2010 – 2022. The threshold index, which is the border between low and high convergence is the standard error of the estimated regression, which is 0.035 (see Bayoumi and Eichengreen (1996), Komarek, Cech and Horvath (2003) and Horvath and Komarek (2003) for more on this). We consider the indices for the bilateral real exchange rates for all ECOWAS countries against Nigeria and Cote d'Ivoire, being the two biggest economies from both WAMZ and UEMOA, and core ECOWAS members to which other members would need to converge with. Nigeria has also been one of the best performers among the WAMZ countries in meeting the macroeconomic convergence criteria in recent years.

### 4.3.1 Analysis of OCA Indices with Nigeria

The computed OCA indices for ECOWAS countries with Nigeria is contained in Table 3 below.

**Table 3: OCA Indices for ECOWAS Countries with Nigeria**

| | Nigeria | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | Benin | Burkina Faso | Cape Verde | Cote d'Ivoire | Gambia | Ghana | Guinea Bissau | Guinea | Liberia | Mali | Niger | Senegal | S/Leone | Togo |
| 2010 | 0.080 | 0.052 | 0.064 | 0.080 | 0.052 | 0.030 | 0.063 | 0.103 | 0.013 | 0.060 | 0.053 | 0.063 | 0.091 | 0.064 |
| 2011 | 0.045 | 0.053 | 0.037 | 0.034 | 0.063 | 0.036 | 0.058 | 0.070 | 0.034 | 0.042 | 0.048 | 0.036 | 0.038 | 0.049 |
| 2012 | 0.039 | 0.034 | 0.051 | 0.036 | 0.040 | 0.056 | 0.067 | 0.021 | 0.042 | 0.058 | 0.036 | 0.044 | 0.066 | 0.040 |
| 2013 | 0.041 | 0.033 | 0.017 | 0.052 | 0.060 | 0.042 | 0.026 | 0.019 | 0.024 | 0.023 | 0.036 | 0.025 | 0.068 | 0.036 |
| 2014 | 0.027 | 0.025 | 0.033 | 0.039 | 0.085 | 0.170 | 0.041 | 0.026 | 0.035 | 0.024 | 0.036 | 0.026 | 0.037 | 0.027 |
| 2015 | 0.028 | 0.030 | 0.018 | 0.052 | 0.084 | 0.033 | 0.036 | 0.063 | 0.075 | 0.036 | 0.034 | 0.039 | 0.081 | 0.042 |
| 2016 | 0.151 | 0.155 | 0.146 | 0.166 | 0.123 | 0.110 | 0.153 | 0.086 | 0.120 | 0.157 | 0.158 | 0.157 | 0.068 | 0.160 |
| 2017 | 0.113 | 0.113 | 0.101 | 0.123 | 0.093 | 0.023 | 0.110 | 0.097 | 0.089 | 0.108 | 0.110 | 0.113 | 0.031 | 0.114 |
| 2018 | 0.068 | 0.068 | 0.055 | 0.077 | 0.056 | 0.037 | 0.065 | 0.047 | 0.063 | 0.064 | 0.068 | 0.069 | 0.029 | 0.068 |
| 2019 | 0.066 | 0.064 | 0.051 | 0.072 | 0.056 | 0.030 | 0.061 | 0.046 | 0.065 | 0.059 | 0.066 | 0.066 | 0.034 | 0.064 |
| 2020 | 0.064 | 0.062 | 0.048 | 0.068 | 0.056 | 0.029 | 0.058 | 0.045 | 0.066 | 0.056 | 0.068 | 0.062 | 0.035 | 0.062 |
| 2021 | 0.063 | 0.059 | 0.046 | 0.064 | 0.055 | 0.030 | 0.056 | 0.044 | 0.066 | 0.054 | 0.064 | 0.060 | 0.037 | 0.059 |
| 2022 | 0.058 | 0.055 | 0.043 | 0.061 | 0.052 | 0.031 | 0.054 | 0.039 | 0.065 | 0.051 | 0.062 | 0.055 | 0.039 | 0.057 |

From the table, we can observe that the OCA indices witnessed severe fluctuations during the period 2010 to 2016. However, average OCA indices during the period showed that Liberia, Cape Verde and Sierra Leone have the lowest indices with Nigeria, closely followed by Guinea, Burkina Faso and Ghana in that order. Even though Guinea has the highest index among all the countries in 2010, it dropped significantly between 2012 and 2014 to less than one standard error, revealing that it stands to benefit from forming a currency union with Nigeria during that period. It is evident from Guinea's macroeconomic reports that the country witnessed minimal exchange rate movements and have met most of the primary and secondary convergence criteria for joining the WAMZ during the period.

We used the OCA forecast index for the year 2020 to partition the ECOWAS countries into three groups: those exhibiting high level of convergence with OCA indices being one standard error or less (Ghana and Sierra Leone); those which are converging faster with OCA indices being lower than 0.06 (Guinea, Cape Verde, The Gambia, Mali and Guinea Bissau) and those that are converging at a slower pace and having OCA indices higher than 0.06 ( Burkina Faso, Togo, Senegal, Benin, Liberia, Cote d'Ivoire, and Niger). Beyond 2020, most ECOWAS countries exhibited declining indices signifying their readiness to join the ECOWAS Single Currency Programme.

Results for 2022 revealed improved real convergence between Nigeria and other ECOWAS countries, as most countries recorded lower OCA indices than in 2020. Four WAMZ countries and Cape Verde would still converge with Nigeria faster than all the UEMOA countries during the year 2022, while Liberia recorded the highest index during the period.

### 4.3.2 Analysis of OCA Indices with Cote d'Ivoire

Table 4 below presents the OCA indices for ECOWAS countries with Coted'Ivoire, the largest economy in the UEMOA Zone.

**Table 4: OCA Indices for ECOWAS Countries with Cote d'Ivoire**

| | Cote d'Ivoire | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | Benin | Burkina Faso | Cape Verde | Gambia | Ghana | Guinea Bissau | Guinea | Liberia | Mali | Niger | Nigeria | Senegal | S/Leone | Togo |
| 2010 | -0.002 | 0.022 | 0.008 | 0.032 | 0.065 | 0.006 | 0.071 | 0.054 | 0.008 | 0.018 | 0.080 | 0.003 | 0.062 | 0.003 |
| 2011 | 0.027 | 0.039 | 0.037 | 0.049 | 0.050 | 0.040 | 0.071 | 0.044 | 0.027 | 0.028 | 0.034 | 0.019 | 0.029 | 0.031 |
| 2012 | 0.022 | 0.014 | 0.041 | 0.035 | 0.065 | 0.037 | 0.036 | 0.044 | 0.040 | 0.002 | 0.036 | 0.015 | 0.067 | 0.012 |
| 2013 | 0.005 | 0.012 | 0.035 | 0.086 | 0.088 | 0.017 | 0.052 | 0.034 | 0.026 | 0.009 | 0.052 | 0.017 | 0.044 | 0.006 |
| 2014 | 0.006 | 0.014 | 0.035 | 0.101 | 0.204 | 0.025 | 0.048 | 0.059 | 0.003 | 0.000 | 0.039 | 0.012 | 0.051 | 0.010 |
| 2015 | 0.020 | 0.013 | 0.036 | 0.062 | 0.072 | 0.008 | 0.044 | 0.056 | 0.006 | 0.011 | 0.052 | 0.002 | 0.112 | 0.013 |
| 2016 | 0.007 | 0.005 | 0.022 | 0.049 | 0.075 | 0.005 | 0.091 | 0.056 | 0.007 | 0.003 | 0.166 | -0.003 | 0.108 | 0.008 |
| 2017 | 0.002 | 0.001 | 0.018 | 0.038 | 0.116 | 0.004 | 0.036 | 0.045 | 0.005 | 0.007 | 0.123 | -0.004 | 0.108 | 0.004 |
| 2018 | -0.003 | -0.001 | 0.016 | 0.027 | 0.055 | 0.002 | 0.040 | 0.024 | 0.005 | 0.002 | 0.077 | -0.007 | 0.059 | 0.000 |
| 2019 | -0.006 | -0.003 | 0.014 | 0.023 | 0.057 | 0.001 | 0.037 | 0.025 | 0.004 | -0.001 | 0.072 | -0.009 | 0.050 | -0.002 |
| 2020 | -0.008 | -0.004 | 0.013 | 0.019 | 0.053 | 0.000 | 0.035 | 0.027 | 0.003 | -0.008 | 0.068 | -0.009 | 0.045 | -0.004 |
| 2021 | -0.008 | -0.005 | 0.011 | 0.017 | 0.049 | -0.001 | 0.032 | 0.028 | 0.001 | -0.007 | 0.064 | -0.008 | 0.040 | -0.006 |
| 2022 | -0.009 | -0.004 | 0.010 | 0.016 | 0.045 | -0.002 | 0.034 | 0.029 | 0.001 | -0.008 | 0.061 | -0.010 | 0.035 | -0.007 |

We expect the UEMOA zone to have relatively low variability of their real exchange rates as they have already constituted a monetary union and currently use a single currency. An OCA index analysis between Cote d'Ivoire and all other ECOWAS countries indicated that the indices were found to be lower than 1 standard error across all the UEMOA countries for most of the period. This showed that UEMOA countries have achieved real convergence and the single currency programme benefitted the countries in line with the OCA theory. Meanwhile, Cape Verde also converged with Cote d'Ivoire in most years during the study period, while The Gambia and Liberia would achieve real convergence with Cote d'Ivoire from 2018 onwards, and Guinea would converge from 2020. The OCA analysis also showed that Nigeria, Ghana and Sierra Leone did not converge with Cote d'Ivoire from 2010 to 2016. However, the forecast indices suggest gradual convergence between 2017 and 2022

as they declined by more than half during the period. The results show that OCA indices of the three countries were declining and tending towards convergence.

### 4.3.3 Analysis of OCA Indices with The Gambia and Guinea Bissau

We also examined the convergence level by comparing the OCA indices of all ECOWAS countries with respect to the smallest economies in the WAMZ and UEMOA – The Gambia and Guinea Bissau, respectively. Tables 5 and 6 below present the OCA indices for ECOWAS countries with The Gambia and Guinea Bissau.

**Table 5: OCA Indices for ECOWAS Countries with The Gambia**

| | The Gambia | | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | Benin | Burkina Faso | Cape Verde | Cote d'Ivoire | Ghana | Guinea Bissau | Guinea | Liberia | Mali | Niger | Nigeria | Senegal | S/Leone | Togo |
| 2010 | 0.031 | 0.026 | 0.023 | 0.032 | 0.036 | 0.023 | 0.082 | 0.032 | 0.020 | 0.024 | 0.063 | 0.028 | 0.071 | 0.023 |
| 2011 | 0.080 | 0.089 | 0.073 | 0.049 | 0.080 | 0.097 | 0.039 | 0.079 | 0.082 | 0.082 | 0.040 | 0.081 | 0.040 | 0.082 |
| 2012 | 0.017 | 0.017 | 0.024 | 0.035 | 0.039 | 0.042 | 0.050 | 0.057 | 0.043 | 0.041 | 0.060 | 0.022 | 0.080 | 0.017 |
| 2013 | 0.082 | 0.074 | 0.053 | 0.086 | 0.040 | 0.068 | 0.073 | 0.070 | 0.074 | 0.072 | 0.085 | 0.072 | 0.111 | 0.074 |
| 2014 | 0.096 | 0.084 | 0.068 | 0.101 | 0.103 | 0.079 | 0.084 | 0.073 | 0.104 | 0.099 | 0.084 | 0.090 | 0.068 | 0.092 |
| 2015 | 0.088 | 0.077 | 0.086 | 0.062 | 0.105 | 0.077 | 0.040 | 0.022 | 0.082 | 0.079 | 0.123 | 0.072 | 0.148 | 0.079 |
| 2016 | 0.038 | 0.043 | 0.033 | 0.049 | 0.030 | 0.042 | 0.060 | 0.016 | 0.055 | 0.041 | 0.093 | 0.049 | 0.071 | 0.043 |
| 2017 | 0.033 | 0.033 | 0.021 | 0.038 | 0.084 | 0.031 | 0.026 | 0.019 | 0.041 | 0.025 | 0.056 | 0.036 | 0.084 | 0.031 |
| 2018 | 0.022 | 0.023 | 0.013 | 0.027 | 0.032 | 0.020 | 0.032 | 0.024 | 0.033 | 0.018 | 0.056 | 0.026 | 0.044 | 0.019 |
| 2019 | 0.020 | 0.019 | 0.012 | 0.023 | 0.038 | 0.017 | 0.033 | 0.026 | 0.031 | 0.016 | 0.056 | 0.022 | 0.039 | 0.016 |
| 2020 | 0.018 | 0.017 | 0.012 | 0.019 | 0.038 | 0.016 | 0.034 | 0.027 | 0.031 | 0.019 | 0.055 | 0.019 | 0.037 | 0.013 |
| 2021 | 0.018 | 0.015 | 0.012 | 0.017 | 0.036 | 0.017 | 0.033 | 0.027 | 0.032 | 0.015 | 0.052 | 0.017 | 0.034 | 0.012 |
| 2022 | 0.014 | 0.013 | 0.011 | 0.016 | 0.033 | 0.016 | 0.035 | 0.027 | 0.032 | 0.016 | 0.028 | 0.015 | 0.030 | 0.011 |

**Table 6: OCA Indices for ECOWAS Countries with Guinea Bissau**

**Guinea Bissau**

| | Benin | Burkina Faso | Cape Verde | Cote d'Ivoire | Gambia | Ghana | Guinea | Liberia | Mali | Niger | Nigeria | Senegal | S/Leone | Togo |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 2010 | 0.005 | 0.012 | 0.016 | 0.006 | 0.023 | 0.047 | 0.079 | 0.043 | -0.001 | 0.010 | 0.063 | -0.003 | 0.070 | -0.003 |
| 2011 | 0.018 | 0.002 | 0.022 | 0.040 | 0.097 | 0.037 | 0.115 | 0.039 | 0.014 | 0.025 | 0.058 | 0.018 | 0.073 | 0.007 |
| 2012 | 0.024 | 0.025 | 0.015 | 0.037 | 0.042 | 0.027 | 0.069 | 0.084 | 0.001 | 0.044 | 0.067 | 0.017 | 0.107 | 0.021 |
| 2013 | 0.009 | 0.002 | 0.014 | 0.017 | 0.068 | 0.055 | 0.033 | 0.028 | -0.001 | 0.003 | 0.026 | -0.005 | 0.067 | 0.003 |
| 2014 | 0.015 | 0.006 | 0.009 | 0.025 | 0.079 | 0.167 | 0.033 | 0.031 | 0.018 | 0.018 | 0.041 | 0.005 | 0.026 | 0.015 |
| 2015 | 0.008 | -0.003 | 0.025 | 0.008 | 0.077 | 0.057 | 0.058 | 0.070 | -0.004 | -0.001 | 0.036 | 0.000 | 0.100 | 0.001 |
| 2016 | 0.001 | -0.002 | 0.016 | 0.005 | 0.042 | 0.060 | 0.083 | 0.045 | 0.000 | -0.003 | 0.153 | 0.001 | 0.100 | 0.002 |
| 2017 | -0.002 | -0.001 | 0.012 | 0.004 | 0.031 | 0.101 | 0.028 | 0.035 | -0.005 | -0.001 | 0.110 | 0.000 | 0.100 | -0.002 |
| 2018 | -0.003 | -0.002 | 0.010 | 0.002 | 0.020 | 0.040 | 0.033 | 0.029 | -0.006 | -0.005 | 0.065 | 0.000 | 0.052 | -0.004 |
| 2019 | -0.002 | -0.003 | 0.009 | 0.001 | 0.017 | 0.043 | 0.031 | 0.031 | -0.005 | -0.006 | 0.061 | -0.001 | 0.044 | -0.005 |
| 2020 | -0.001 | -0.003 | 0.008 | 0.000 | 0.016 | 0.041 | 0.029 | 0.032 | -0.006 | -0.001 | 0.058 | -0.001 | 0.039 | -0.005 |
| 2021 | 0.000 | -0.003 | 0.008 | -0.001 | 0.017 | 0.037 | 0.027 | 0.033 | -0.007 | -0.003 | 0.056 | -0.001 | 0.035 | -0.005 |
| 2022 | -0.004 | -0.005 | 0.007 | -0.002 | 0.016 | 0.034 | 0.029 | 0.033 | -0.007 | -0.003 | 0.054 | -0.004 | 0.031 | -0.006 |

From the tables, we observe that about 11 of the 14 ECOWAS countries, with the exception of Ghana, Nigeria and Sierra Leone, converge with The Gambia and Guinea Bissau in 2020. All the countries tend towards achieving real convergence with The Gambia in 2022. Similarly, all the countries, except Nigeria, converge with Guinea Bissau in 2022.

Overall, the analyses above suggest that the formation of a monetary union within the ECOWAS region should assume a gradual approach. In the interim, WAMZ countries should intensify efforts at meeting the ECOWAS nominal macroeconomic convergence criteria on a sustained basis, as this would make the countries move faster towards real convergence.

## 5.0 CONCLUSION

This study examined the readiness of ECOWAS countries to form a monetary union. It also assessed the speed of real convergence in the region during the period from 2010 to 2022. An econometric model was first estimated to ascertain the factors that determine the bilateral real exchange rate variability among the ECOWAS countries. The estimated model was then utilized to compute the OCA indices for the countries to determine their readiness to participate in a single currency program. Results from the OCA analysis revealed that ECOWAS countries could be divided into three groups: the first group are countries exhibiting high level of convergence suggesting that they would be ready to join the monetary union at the proposed date of 2020; the second group of countries are exhibiting medium level of convergence and may follow shortly after 2020; while the third group are those converging at a much slower pace and would require more time to achieve convergence beyond the 2020 date.

The main conclusion from the paper is that countries that fall into the first category should as a matter of emphasis sustain their achievement in meeting the real convergence while the countries in the second and third categories should intensify efforts towards ensuring that they meet the ECOWAS convergence criteria. On a general note, the whole effort towards monetary integration in ECOWAS should follow a gradualist approach.

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