Currency Fusion and Trade Flows in West African Countries Application of the Gravity Model

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ABSTRACT

Currency fusion to certain extent has been a subject of discussion within the modern economic era. Though, the West Africa formed their monetary institute (i.e. West Africa Monetary Institute, WAMI) however, the practice of common currency within the region is thinly accepted. This study then focuses on the economic fundamentals of currency union within the zone placing it firmly on the context of the theory of gravity model and by extension trade, with special reference to West African countries. Panel data estimation techniques were adopted; followed by the stability tests: standardized residual and confidence ellipse. The findings indicate that population growth is risk-free to the decision on currency union and, particularly, trade is another huge benefit in return for the adoption of currency fusion program within the West African region.

Keywords: gravity model, output growth, optimum currency areas, panel co-integration, panel unit roots test, confidence ellipse, fixed effect model and random effect model.

JEL Classification: A10, F12, F13, F16, F42, F43, F50

1. INTRODUCTION

Amidst the earlier facets by various academicians, reformers and outstandingly, policy makers is the general debate on monetary integration. Interest in common currency has been increasing in recent years, initially general consensus had focused more on the European region spurred by the European monetary integration and adoption of unified global currency which results in the lingering appetite of regions assessing the possibility of entering into monetary union. Africa with its decades of history partly been colonized by the British and French[3], Ethiopia of the exception has not been colonized by any of these aforementioned regions. These differing approaches remain apparent with the Francophone zone (now tagged with the Euro) and with other countries that are generally colonies of Britain, Belgium, Spain and Portugal i.e. **the BBSP** using their own currency, while the CMA Rand zone is the only two single currency areas in Africa.

Interest in regional co-operation and integration has long been proposed and achieved in Africa; however, commitment towards having a single regional currency is farfetched. This can be achieved through progressive integration of countries within the selected region, for the sake of clarity of exposition and analysis this study will focus on the West African countries. The major problem facing the integration of West African Countries is the differing policies adopted by countries, in addition the inclusion of some countries with despairing resource with the highly profile countries might ended in unprecedented union. In other to buttress this point, Different communities, at this stage at least, have created different operating strategies for the harmonization of trade policies and dissolution of tariff and non-tariff barriers and by so doing, membership in multiple communities will make difficult and confuse the harmonization process. It would be preferable, earlier rather than later, to streamline the system of regions to ensure there is no redundancy of effort in terms of conflicting country membership.

This study then seeks to contribute to the existing debate on common currency theoretically and empirically, with particular reference to the branch of economic theory that has become known as Optimal Currency Area

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[3] Masson and Patillo (2005) presents the post independence experience of most African countries into three generalized approaches namely: the experience of Francophone countries which remained linked to the French Franc, the experience of the colonies of European countries and that of the Southern African economies which were generally attached to the South Africa.

(OCA). After the introductory section the second section is an extensive literature review separated between purely theoretical developments and empirical discussion to exhume OCA theory. The empirical investigation referenced in this study seeks to answers one crucial policy questions of interest, namely: What is the trade effect of currency union membership on intra-West-African trade? This question is answered by using a perversion of gravity model analysis of intra-West-African trade respectively. Section three shall elucidate the methodology and model framework in which the analysis will be based, using a variety of macro-econometric techniques. Section four will consists of empirical implementation and results, lastly, the paper shall be concluded in Section five by highlighting the conclusions relating to the findings of the study made in section four, as well as exhume further related research and suggest some policies which can be observed from the study.

2. REVIEW OF RELEVANT LITERATURE

Mundell's Innovative preachings:

The discussion on Optimal Currency Areas (OCA) begins with the seminal work by Mundell (1961) and I shall not break with tradition here. Mundell started his presentation by asking the pertinent question "What is the appropriate domain of a currency area?" (Mundell 1961: 657) by way of hypothetical examples, Mundell explains how changes in consumption patterns under sticky price assumptions can have different economic outcomes dependant on the location and nature of the changes and the monetary and exchange rate policy pursued. However, if the changes in consumption patterns do not coincide with national and currency boundaries then a flexible exchange rate is able to maintain external balance but is ineffective in alleviating the related problems of inflation and unemployment. Mundell uses the US and Canada as an example.

TABLE 1: SUMMARY OF SELECTED AFRICAN STUDIES

Author(s)	Pub. Date	Methodology	Area	Conclusions
Bayoumi and Ostry	*1997*	*VAR*	*Sub Saharan Africa*	*Little evidence for monetary union suitability in the near future.*
Hoffmaister et al.	*1998*	*VAR*	*Sub Saharan Africa*	*External macroeconomic shocks are more detrimental within the CFA area.*
Fielding and Shields	*2001*	*VAR*	*CFA*	*Correlation in price movements but not output movements. In terms of output, two subsets are apparent.*
Benassy-Quere and Coupet	*2003*	*Cluster Analysis*	*ECOWAS*	*Neither CFA nor ECOWAS are suitable for monetary union.*
Debrun, Mason and Patillo	*2003*	*Macroeconomic Modelling*	*ECOWAS*	*Success of ECOWAS dependant on the creation of credible central bank able to control individual members fiscal spending*
Fielding, Lee and Shields	*2004*	*VAR*	*CFA*	*Less heterogeneity in UEMOA than in CEMAC which suggests lower costs of monetary union. Stabilisation under a CFA monetary union would prove difficult.*

Note: Table 1 is compiled by the Author based on previous literatures

Mundell's arguments results in various key conclusions: Firstly, the presence of asymmetric demand movements within a currency area (that is a currency area composed of multiple regions) creates the inverse problems of inflation and unemployment regardless of the external exchange rate regime adopted. Secondly, factor mobility, particularly labour mobility, both geographical and industrial can compensate for regional differences within a multi-region currency area and as such can replace a system of individual regional currencies. Thirdly, there are important limiting factors, unrelated to the stabilization arguments forwarded by Mundell, which prevent a

system of purely regional currency areas. These relate to convenience of money as a medium of exchange, transactions and valuations costs associated with currency exchange, the problem of thin exchange markets with regard to speculation and finally the increasing implausibility of the assumption of money illusion as the number of currencies (and therefore imported goods) increases. Importantly, he also brings attention to Scitovsky's conclusion that a "common currency… [in this case in Western Europe] …would induce a greater degree of capital mobility" (Scitovsky cited in Mundell 1961). The importance of capital markets, and the possible catalysing effect a common currency may have on them.

Earlier Empirics:

McKinnon (1963) extended the theory of OCAs by considering the implications of differing sizes and structures of economies on the optimal exchange rate regime. Primarily, where economies are relatively open, variable exchange rates have a significant effect on internal price levels since the ratio of tradables to non-tradables is high and devaluation increases the cost of tradables. Given the conflicting aims of employment maximization, external balance and internal price stability, an open economy with variable exchange rates may be able to control the former two but the rising cost of tradables will impact on the latter aim: thus open economies have less to lose from moving from variable exchange rates to a single currency. McKinnon also highlights the importance of size and credibility effects in creating and maintaining currency liquidity and capital efficiency. The notion of credibility and its achievement are important in "new" OCA theory too, most notably in the application of work by Barro and Gordon (1983) concerning central bank credibility.

The Werner Report, published in October of 1970, accompanied by an increased move towards an international system of flexible exchange rates during the early 1970's, gave increased impetus to a more rigorous theoretical dialogue, termed by Mongelli (2002) as the "cost-benefit phase" subsequent to the "pioneering phase" of OCA theory seen above. Work by Corden (1972), Ishiyama (1975) and Tower and Willett (1976) are said to characterise this phase, with a greater emphasis of weighing the specific pros and cons of monetary integration in comparison with other exchange rate arrangements, occasionally with particular reference to the European Project. Whilst the work reviewed above tended to give vague indications of when monetary integration would be most beneficial, or more accurately when the loss of exchange rate controls would be less detrimental, the "cost-benefit" type analysis sought to clarify the varying costs and expand on the benefits discussed in previous work. I shall not discuss these contributions in any detail, but will indicate where they have enhanced or changed the dominant view on optimal currency areas.

Corden (1972) highlights several oversights in the preceding arguments of OCA theory. Notably, though monetary integration increases the price stability of an economy, and the improvement increases with the openness of an economy, exchange rates can play an "insulating role". Previous arguments assumed stable foreign prices and micro-orientated supply and demand shifts but where shocks "originate abroad and are of a macro nature" (Corden 1972), exchange rate fluctuations are able to insulate the domestic currency from foreign shocks, increasing its liquidity. Thus the benefits to be gained from monetary integration are dependent on the assumptions made concerning the disturbances to the system: where the disturbances are structural micro shocks to the domestic economy, McKinnon's argument for monetary integration applies according to Corden. But where they represent foreign macro movements in costs and prices, increased openness may increase the costs of monetary integration.

Tower and Willett (1976) discuss in great detail several broad areas of importance in determining the costs and benefits of the economy. They arrive at a graphical synthesis that summarises the relative net benefits of a system of flexible exchange rates compared with those of a currency area. They show that as the degree of openness increases, the benefits of a currency area rise whilst the benefits of a flexible exchange rate fall. The determinants of both openness and flexible exchange rate are diverse and relate to previously discussed concepts such as source and magnitude of disturbances, effectiveness of monetary policy induced adjustment, labour and capital mobility and price flexibility. They also concede that alternative assumptions may result in multiple equilibria where over some range of openness, the benefits of a currency area may actually be falling. However, this does not alter Tower and Willett's conclusion that very open economies would benefit from adopting a currency area, whilst much closed economies should operate a system of fixed exchange rates.

Modern Empirics:

Previous analysis made by the early contributors to OCA theory held the stand that monetary policies could be used to achieve the desired trade-off between inflation and output, as given by the Phillips Curve. Thus,

monetary integration, which necessarily requires the desertion of national monetary policy to a centralized body, and thus, exerts a cost in so much as countries state of monetary policy implementation are unable to fine-tune the economy to the desired balance and regulate the disequilibrium between inflation and output. The Monetarist Critique, exemplified by Lucas (1972) and Friedman (1968), asserts that in the long run, monetary policies are ineffective in controlling output. The Phillips Curve becomes vertical in the long run since unemployment is related to the Natural Rate of Unemployment (NRU) and inflation can be controlled without detrimental effects on the level of long run output vis-à-vis unemployment. Theory was enhanced by the prevalent economic problems in Western countries, where inflation and output were simultaneously and persistently high. Though the Phillips Curve may still exist in the short run the major implication for OCA theory is that the perceived costs of monetary integration are reduced since monetary policy is ineffective in balancing unemployment and inflation in the long run. The costs of monetary integration are reduced though there remain important cases and issues surrounding the notion of money neutrality when considering currency unions.

De Grauwe (2000) highlights the body of work initiated by Poole (1970) that uses an IS-LM model to show that fixing exchange rates i.e. forming a currency union results in increased volatility in output. Reduced exchange rate uncertainty simply moves the risk to another area of the economy. Furthermore, De Grauwe (2000) highlights the one-off benefit to growth of an increase in exchange rate certainty that is indicated by neoclassical theory and was used in the influential 'One Money, One Market' report EC 1990. This suggests that though monetary integration will reduce risk, this effect will only have a one off effect on growth.

However, the contribution by Frankel and Rose (1997) provided OCA theory with a more forward looking outlook, arguing that many of the prerequisites for monetary union, espoused by traditional theorists, are in fact reinforced by the creation of monetary union. This is in direct contrast with another popular argument from Krugman (1993) that increased economic integration increases the likelihood of asymmetric shocks. Krugman's outcome is a result of the possibility of increased localized specialization which increases rather than decreases the divergence of shocks between two countries, thus increasing the cost of monetary union.

Frankel and Rose (1997) believe that increased economic integration (including, most importantly, customs and monetary union and increasing factor mobility) increases convergence between nations, hence reducing the costs of monetary union in terms of loss of exchange rate control, empirical evidence tends to suggest that Frankel and Rose's (1997) hypothesis is correct for the countries that have been studied, predominantly in the European Union. Artis and Zhang (1995) show that increasing trade links in Europe gravitated members of the European Monetary System towards a universal business cycle. Fidrmuc (2001) uses an explicit test of endogeneity to confirm Frankel and Rose's hypothesis, though with the caveat that the effect may be working through increasing structural similarities of foreign trade rather than the direct affect of increased trade, as earlier empirics suggested. Bayoumi and Eichengreen (1994, among others) in relation to the EMU and other possible single currency areas adopted the structural vector authoregressive (SVAR) modeling. First, the SVAR techniques developed by Blanchard and Quah (1989) are implemented to isolate demand and supply shocks in a selection of economies using time series data of real and nominal output growth. The correlation of these shocks is then assessed, with greater weight being placed upon supply shocks by Bayoumi and Eichengreen (1994) since they are "…more likely to be invariant with respect to alternative international monetary arrangements". The method also has the strength to predict the size of disturbances and the speed of adjustment, further shedding light on the question of monetary union. Bayoumi and Eichengreen (1994) find that several potential currency areas emerge from their analysis of supply and demand shocks. These areas are Germany and its North European neighbours, North-East Asia and South-East Asia. Suitability for monetary union was not found in the Americas and was assessed for neither Africa nor West African.

Figure 2: *FACETS OF MONETARY INTEGRATION*
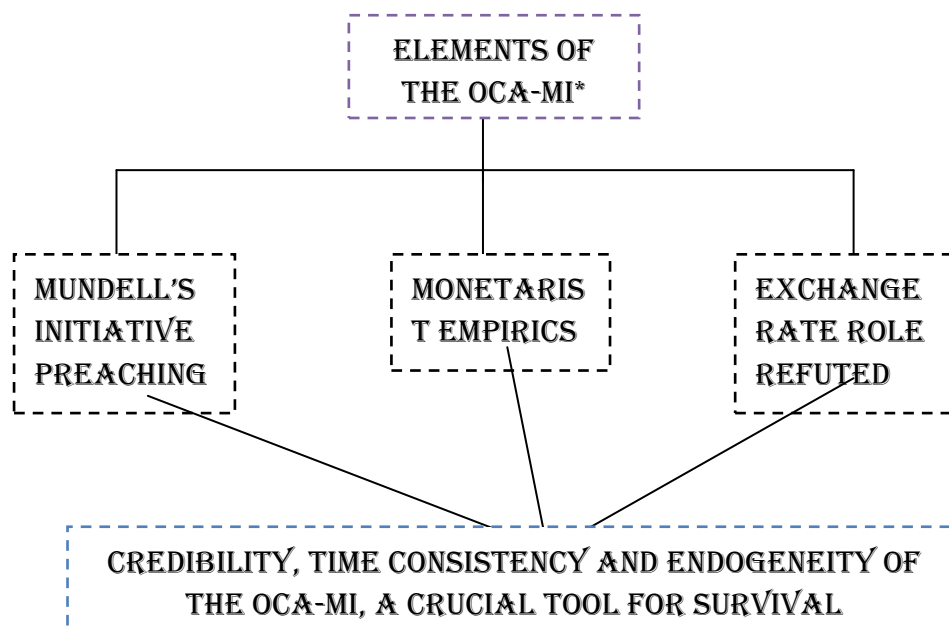
Note: *The calibration **OCA-MI** simply represents the Optimal Currency Area (an equivalent expression for common currency region) and Monetary Integration.*

3. THEORETICAL FRAMEWORK AND METHOD

Theoretical and Methodological Framework:

Much of the theoretical literature is presented and developed from the seminal work of Mundell (1961) and relates to the generalised concept of an "Optimal Currency Area" (OCA). Mundell's (1961) work was further supplemented by important offerings from McKinnon (1963) and Kenen (1969). This body of work laid the theoretical foundations for many of the new developments and empirical work that began to emerge some 10 or 15 years later. This emergence of empirical applications was partly due to increasing mathematical sophistication on the part of scholars, and perhaps more importantly to the increasing political movements of the European Community towards a proposed single European currency. Subsequently much of the empirical literature reviewed here will be regarding the creation of a single European Currency rather than an African currency. This will not adversely affect the study however, since evaluation of the empirical literature is undertaken to assess and define appropriate empirical methodologies for the current study rather than gain any insight into the success or otherwise of a possible (now real) European Currency area. When concluding this review of the empirical literature I will also comment on the few studies that have been made concerning regional and continental monetary integration in Africa.

The gravity model is fairly well used in the literature, relating bilateral trade to a number of standard variables such as geographical size, distance and wealth. Here, as in Rose and Glick (2002), we supplement the conventional gravity model with several control variables in order to isolate the effect of currency union membership on trade. The estimated equation is therefore

$$\ln(X_{ijt}) = \beta_0 + \beta_1 \ln(Y_i Y_j)_t + \beta_2 \ln(Y_i Y_j / Pop_i Pop_j)_t + \beta_3 \ln D_{ij} + \beta_4 Lang_{ij} + \beta_5 Bord_{ij}$$
$$+ \beta_6 REC_{ijt} + \beta_7 Land_{ij} + \beta_8 Island_{ij} + \beta_9 \ln(Area_i Area_j) + \beta_{10} ComCol_{ij} + \beta_{11} ComNat_{ijt}$$
$$+ \beta_{12} RTA_{ijt} + \gamma CU_{ijt} + \varepsilon_{ijt}$$

Where subscripts i and j denote countries, t denotes years and the variables are defined as:

X_{ijt} denotes the average value of real bilateral trade between countries i and j at time t,

Y is real GDP,

Pop is population,

D is the Greater Circle Distance between i and j,

$Lang$ is a binary variable which is unity if i and j have a common language,

$Bord$ is a binary variable which is unity if i and j share a land border,

RTA is a binary variable which is unity if i and j are part of the same WTO ratified regional trade arrangement

REC is a binary variable which is unity if i and j are part of the same regional co-operation agreement at time t,

$Land$ is the number of landlocked countries in the country pair (0, 1 or 2),

$Island$ is the number of island nations in the country pair (0, 1 or 2),

$Area$ is the surface land mass of the country,

$ComCol$ is a binary variable which is unity if i and j were ever colonies after 1945 with the same coloniser,

$ComNat$ is a binary variable which is unity if i and j were part of the same Nation at time t,

CU is a binary variable which is unity if i and j used the same currency at time t

ε represents the range of other factors that influence bilateral trade, assumed to be well behaved.

Clearly, in assessing the case for monetary integration, the variable of interest is CU and the value of its coefficient, γ, will determine the extent to which monetary integration increases bilateral trade within the African continent. Further to this, I am interested in the effect of the REC's and other WTO agreed trade arrangements. For this purpose, the coefficients β_6 and β_{12} are also of interest and will be discussed. From both theoretical intuition and past empirical research I expect all three of these coefficients to be positively and significantly related to the level of trade.

Based on an intuitive adjustment to the standard Gravity models of trade and pioneered by Rose (2000), the aforementioned studies in their contribution isolate the effect of trade of monetary union from other factors cited in their works, these other factors also influence the value of trade between countries. Succinctly, gravity models are found to be very helpful and interestingly robust in response to its paraphernalia and significant coefficients on a consistent basis[4].

In an attempt to evaluate the applicability of the Gravity model in the West Africa framework as demanded by the aim of the study, the aggregate model of the gravity model in equation (1) can be re-expressed in the form below for clarity of exposition and constructive estimation.

$$(X_{ijt}) = \beta_0 + \beta_1(Y_iY_j)_t + \beta_2(Y_iY_j / Pop_iPop_j)_t + \beta_3 Pop_{t-iij} + \beta_4 REC_{ijt} + \beta_5 Land_{ij} + \beta_6 Pop_iPop_{jij}$$
$$+ \beta_9 \ln(Area_iArea_j) + \beta_{12}(Y_i - Y_j)_{ijt} + \delta_i CE + \varepsilon_{ijt} \tag{2}$$

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[4] Leamer and Levinsohn (1995) describe the models as having the clearest and most robust findings in international economics and finance.

Where all definition of variables remains as it is defined above in the aggregate model subdue in equation (1) above.

3.1   Data and Data Sources

The trade data was sourced from the International Monetary Fund (IMF) Economic and Financial statistics, on the IMF website the volume of trade and bilateral trade data started from 1968 to 2015, from 2012 to 2015 are forecasted series made by the IMF experts for the sake of unification of data across all West African countries, the data use in this analysis ranges is restricted to the period of 1980 to 2013. Population dataset were sourced from ECOWAS website and the restriction placed on trade data also applies to the population, meanwhile, the gross domestic product i.e. output of each country was sourced from the national bank of various countries; the data ranges from 1980 to 2013, respectively. However, in the specification, the currency union effect (CE) is also included in model in equation (2). Given the data limitation and challenges in West African countries, this paper however, differs from that presented by Rose and Glick (2002) by including countries with zero bilateral trade. It also restrain from the double log specification proposed by Adams (2005), as the model specification offered here in this paper is linear specification which create an environment for the proclamation of the proposition of "Let the data speak for itself" instead of unnecessary smoothing done by Adams (2005).

4.0   PRESENTATION OF EMPIRICAL RESULTS

The iteration of results commence with the descriptive statistics followed by the panel unit root and cointegration tests. This is then followed by the model specification test (Hausman Test), the Hausman test determines which of the specification approach i.e. Random or Fixed effects measure - in which the paper finally adopt. Lastly, the panel ordinary least squares result is then presented to portray the impact assessment of the significance of common currency within the West African framework.

4.1   Descriptive Statistics

The descriptive statistics of the dataset used is depicted in Table 2 below; more so, the table also consists of the unit root tests of the group series. The unit root test was conducted using three approaches but the values of the Lm, Pesaran and Shin W-Statistics was reported due to the structural divergence presence in the dataset as reported by the pooled statistics in the Hausman test to be discussed later in the interpretation of empirical results. Other unit root test conducted by the studies include the Augmented Dickey Fuller –Fischer Chi-Square and the Phillip Perron –Fisher Chi Square, these two test statistics supported the reported test by showing that all the variables were found stationary at levels except population which was as a result used as the bases for sensitivity analysis in the panel least square results. The Jarque Bera tests indicates that the all the variables were normally distributed which suggested the applicability of the Least Square approach which was later used. Most of the series were positively skewed expect for output growth and differenced output population series for all the countries. However, the Kurtosis reported positive values of distribution for all variables considered.

Table 2: Descriptive Statistics and Unit Root Results

Descriptive and Unit Root Results						
	Output	*Bilateral Trade*	*Coverage*	*Population*	*REC**	*optpop***
Mean	*3.491*	*4.125*	*7.688*	*15.051*	*2.79*	*-11.561*
Median	*4.002*	*0.066*	*4.12*	*7.516*	*3.047*	*-4.766*
Standard Deviation	*5.039*	*18.315*	*30.772*	*28.589*	*16.139*	*28.447*
Skewness	*-0.911*	*1.627*	*7.495*	*3.561*	*0.515*	*-3.386*
Kurtosis	*10.519*	*11.187*	*99.253*	*15.236*	*7.985*	*14.329*
Jarque Bera	*1187.547*	*1539.805*	*188206.7*	*4019.273*	*514.093*	*3455.71*
Probability Value	*0.000*	*0.000*	*0.000*	*0.000*	*0.000*	*0.000*
Observations	*476*	*476*	*476*	*476*	*476*	*476*
Panel Unit Root Tests						
t-stats	*-9.942*	*-7.684*	*-6.043*	*14.262*	*-10.637*	*-7.083*
Prob.	*0.000*	*0.000*	*0.000*	*0.000*	*0.000*	*0.000*
** REC stands for "**Regional Economic Community**"*						
*** optpop represents "**Differenced output and population measure**"*						

Source: Author's Compilation

The Panel cointegration was performed using the Pedroni Residual Cointegration test. The common AR coefficients of the panel cointegration comprises of the panel visual statistics, panel rho statistcs, panel PP statistics and panel ADF statistics, respectively. All these sub division of the Common AR coefficients supported the existence of no cointegration within the group. In the same avenue, the individual AR coefficients which represents the between group measure also validates the decision of zero cointegration among variables as proclaimed by the within group statistics. The weighted statistics also reported the same decision as the unweighted values establishing the fact that the no cointegration decision is acceptable. Hence, the study cannot in this sense write the panel error correction model[5]. The study then, makes use of the traditional panel estimation approach[6]

Table 3: Cointegration Test Result

Pedroni Residual Cointegration Test				
Common AR Coef. (Within Dimension)	*Statistics*	*Prob.*	*Weighted Statistics*	*Prob.*
Panel-v-Statistics	*-5.37*	*1*	*-5.358*	*1*
Panel-rho-Statistics	*5.989*	*1*	*3.555*	*0.999*
Panel-PP-Statistics	*8.378*	*1*	*3.375*	*0.999*
Panel-ADF-Statistics	*7.562*	*1*	*5.496*	*1*
Individual AR Coef. (Between Dimension)	*Statistics*	*Prob.*		
Group-rho-Statistics	*3.363*	*0.999*		
Group-PP-Statistics	*1.971*	*0.975*		
Group-ADF-Statistics	*5.729*	*1*		

Source: Author's Compilation

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[5] See Engel and Granger (1986) representation theorem.

[6] By traditional panel estimation approach, the study simply implies the Pooled, Fixed and Random panel estimation procedures.

4.2   *Panel Least Square Results*

This study employs several traditional panel data estimation techniques as done in Rose and Glick (2002) and Adam (2005). The paper also augments the Gravity model to sooth the African environs. The augmentation allows the use of the regional economic community and the differenced output population which serve as proxy to the currency union effect. Although each measure has their pros and cons, respectively[7], however, the analyses reported in this exercise was based on these traditional methods of panel data estimates. Note that the unavailability of the trade data for Liberia for over two decades requires their exclusion from the analysis making the number of West African countries considered to be fourteen (14) as against fifteen (15) countries as it suppose to be. Furthermore, both the time and individual effects were modeled in both the fixed and random models while the pooled regression model assumed homogeneity instead of heterogeneity assumption. Whilst the forced revaluations of exchange rates and government imposed trade restrictions were particularly included in the modeling in form of the individual and time effects, respectively. In this context, there exist of an ideal intuition in support of the use of both fixed and random models as against the reliance of the analysis of pooled panel estimates. Given these limitations the question of interest becomes "What is the effect of country being or not being part of currency union on Multi/bilateral trade?'.

The constant term of all the three models[8] were found to be insignificant suggesting that the augmented gravity model is robust in capturing the major theme of the discussion. Note, that the values of their constant terms were all positive signifying that there are positive instances behind the explanatory power of the augmented gravity model but these positive impediments were quite insignificant and thus, the positive instances are unreliable for policy analysis. In the result in table 4, the currency union proxy by differenced output and population indentifies that in forming common currency population plays insignificant role as depicted by the insignificant results of the coefficients in all the three models. The intuition behind this result is that, irrespective of the population growth of a nation, especially the West African countries; it has no significant influence on the development of a common currency, put differently, it poses no effect on the decision on monetary integration. Increase in the active populace of these nations may likely have effect in the long run through trade, however, as population itself is used for sensitivity control in this study such question neglected and adjoined for further studies. In brief, population is no influence on common currency formation of West African countries.

Income unification poses positive influence on trade flows as posited by the models. All having close coefficients of approximately sixty one percent effect on trade as a result of one hundred percent/single fold increase in income proxy by output, the output coefficients were all significant in the three models. The pooled and fixed results were significant at five percent level of significant as shown by the probability values of the t-statistics, while the result random model was found significant at one percent level for output coefficient. Intuitively, forming a common currency or currency union is profitable for West African countries as regards to trade. It is obvious from the panel estimates that membership in a cureency union is particularly important for intra West African trade. With the huge influence exhibited by the coefficients, it seems implausible large, more so, taking the point estimates literarily it is apparent that currency union membership increases the trade volume of West African countries.

Coverage vis-à-vis total area or locations of these countries[9] have significant effect on trade flows among these countries. The three models reported positive effects of the location on trade in these countries. The proximity of these countries fosters their trade relations and spur positively on the benefits they earned on trade. The inkling as regards the coverage lies on the fact that closer the borders and common colonizers the further it positive influence on bilateral trade. Hence, currency union becomes trade effective as language barrier will obviously fades out as currency speaks rather than words in the region. Though, the coverage coefficients was found significant for all three models, however, the regional economic community (REC) is not relevant for policy description in all the three models. Thus, it is less important for the debate.

The effects[10] were all fixed in the panel fixed effect model, however, were made to vary in the random model. The results of the random model shows that individual and time effects were highly significant in the model. Thus, for all the coefficients country specific characteristics and periodic policy decision have to be given an

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[7] Interested reader can consult panel data analysis by Badi Balthagi.

[8] The three models include: Pooled, Fixed and Random Models.

[9] The Fourteen West African countries considered in the study, the countries are Benin, Burkina Faso, Cape Verde, Cote Divore, Gambia, Ghana, Guinea, Guinea Bussau, Mali, Niger, Nigeria, Senegal, Sierra Leone and Togo.

[10] These effects were assumed away for the pooled panel estimates based on the assumption of homogeneity for both the time and individual effects.

utmost consideration in embarking on currency unification in West African countries, specifically, intra West African trade. The unsystemic effects were irrelevant as the model is concerned as reported by the probability value of the "rho".

The Hausman specification test therefore tests the systematic difference between the random and the fixed effects models and the chi square test statistics is based upon this difference. The null hypothesis is therefore stated below for clarity of expression:

> H0: Random effect dominates

The result of the hausman test was performed using the EViews software package. The original modeling structure were tested here in the analysis, however, it has nothing to do with the decision if formation of the hypothesis is changed. The chi-sqaure statistics reported 0.0001 with probability values of 0.9999 and 1.000 in most cases showing that the alternate hypothesis is rejected and the null hypothesis of random effect dominates is accepted. Thus, random model form the basis of the analysis in this work.

Table 4: Panel Least Square Estimates

Panel Least Square Estimates			
Details	*Pooled*	*Fixed**	*Random***
Constant term	*0.681 (0.635)*	*0.775 (0.538)*	*0.247 (0.836)*
Output	*0.605 (0.021)*	*0.613 (0.011)*	*0.614 (0.007)*
Coverage	*0.148 (0.001)*	*0.145 (0.001)*	*0.148 (0.004)*
REC***	*0.026 (0.663)*	*0.025 (0.648)*	*0.153 (0.015)*
Differenced Output and population	*0.007 (0.933)*	*(0.007) (0.889)*	*(0.014) (0.624)*
Weighted Statistics			
R-Squared	*0.254*	*0.268*	*0.141*
Adjusted R-Squared	*0.166*	*0.182*	*0.133*
Durbin Watson Statistics	*2.098*	*2.035*	*2.042*
F-distribution	*2.896*	*2.997*	*19.257*
Prob.	*0.000*	*0.000*	*0.000*
Effect Specification			
Cross Section Random	*Nil*	*Fixed*	*0.012******
Period Random	*Nil*	*Fixed*	*0.000******
Idiosyncratic Random	*Nil*	*Fixed*	*0.987*
Unweighted Statistic			
R-Squared	*Nil*	*Nil*	*0.142*
Durbin Watson Statistics	*Nil*	*Nil*	*2.018*
* Comprises of both Within and Between Effects			
** Estimation is via GLS approach			
*** REC as defined earlier			
**** The parentheses represent the probability values of coefficients			
***** The rho is significant at 99% confidence level			

Source: Author's Compilation

4.3   Stability Prowess

The dexterity of the random model stability in this study is based on standardized residual test[11] and the confidence ellipse. The random model's normality test was also reported by the Jacque Bera statistics and its corresponding histogram[12]. The normality test indicates that the overall distribution of the random model was normal which signifies that the application of the panel least square is appropriate as it satisfies the underlying assumption of the econometric method. For the stability properties, firstly, from the standardized residual chart, it is apparent that the random model is averagely stable across time and space. Nonetheless, there are some periods that the oversight of the union exceeds the residual limit; however, these occurrences are negligible. Secondly, the confidence ellipse in figure 3, buttressed the result of the standardized residual test on overall stability of the random model. The ellipse were made on a 4-basis points to capture the stability effects of the quadrants of the square box, from the chart it is seen that the ellipse were saturated within the confidence square box which signifies the stability of the overall specification of the model.

Figure 3: Confidence Ellipse
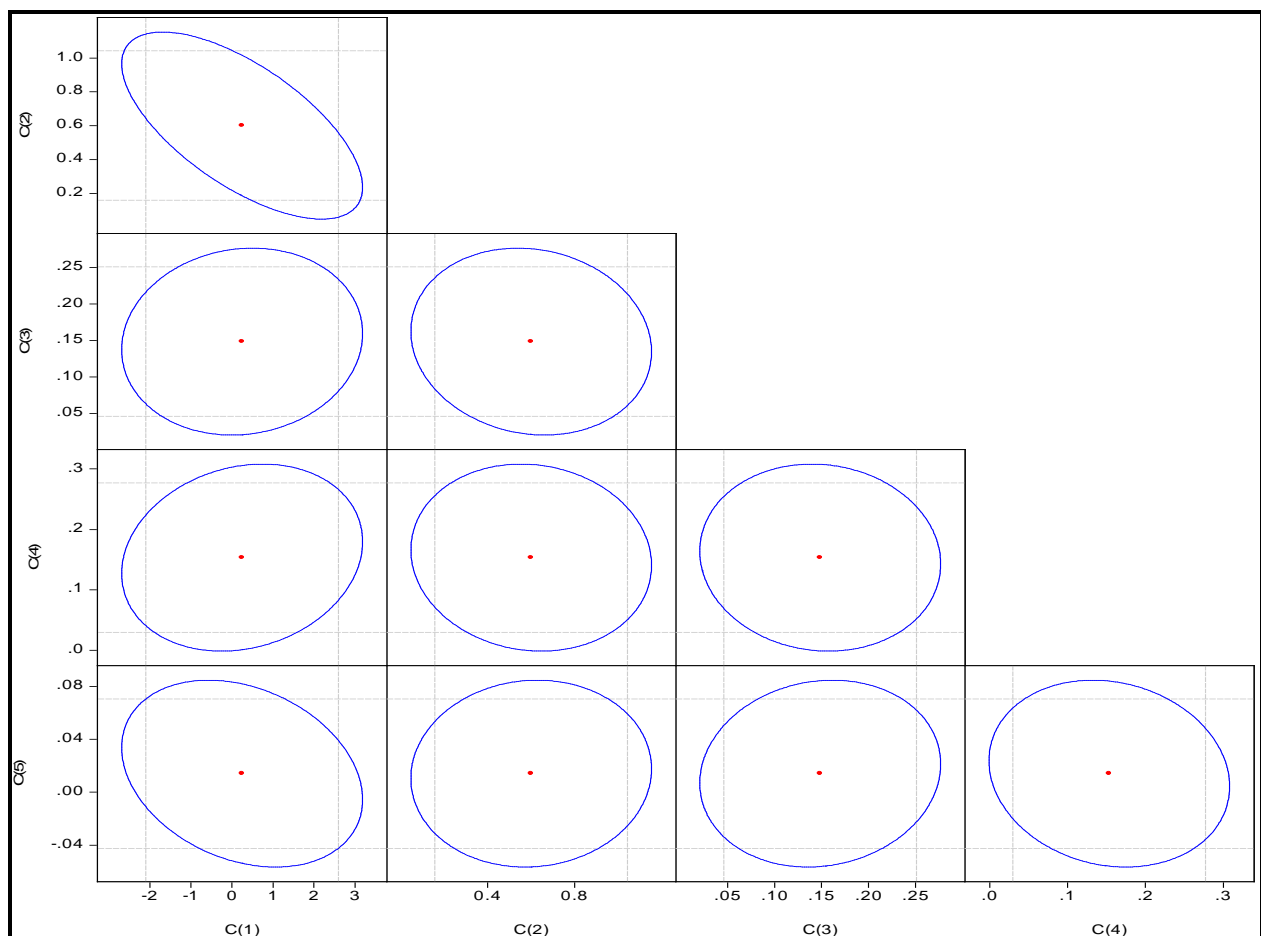
5.0   Conclusion

This study applied the augmented gravity model to the theory of optimal currency areas to West African countries. The literature review in particular, was broken into three different dimensions: the first part covers the Mundell's theory which is widely applied in several related works. The second aspect of the literature is centred on old theoretical and empirical works while the last verdict gave a thorough description of the modern empirics.

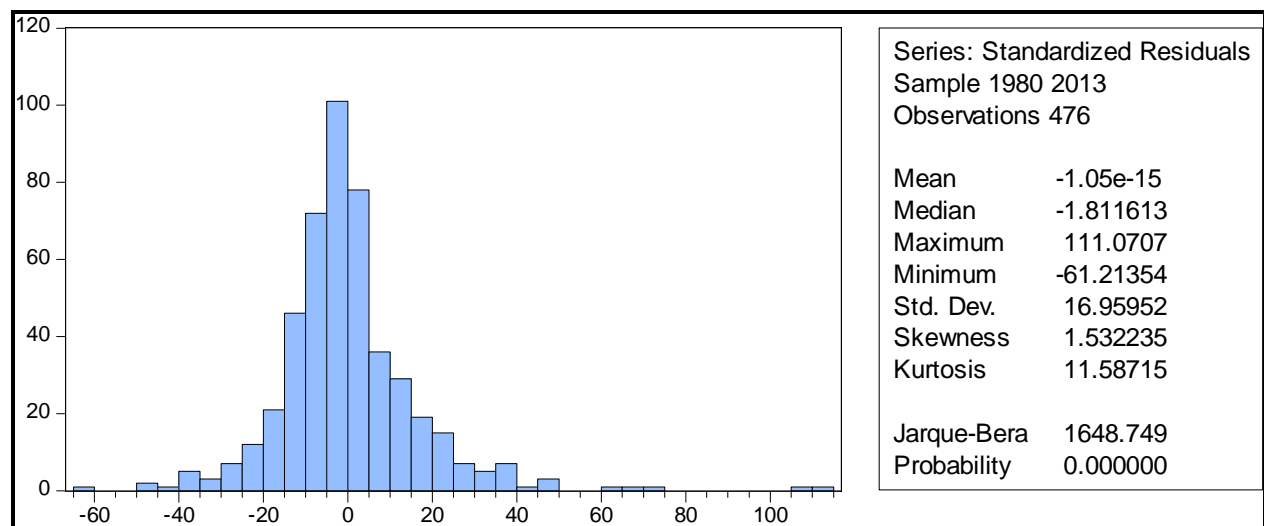[11] See Appendix 2 for the standardized residual chart.

[12] See Appendix 1 for the normality statistics and its histogram.

The gravity model of intra West African trade reported more conclusive and convincing results, finding that membership in a currency union increased the level of bilateral trade. This result was robust to several different panel data techniques and specification alterations but was dependant on analyzing the cross-sectional and time differences in the area. The movements into and out of currency unions was in part a result of the relatively short time scale of the data available. However, discussion on this was quite minute. Despite these limitations it was argued that membership in West African currency union increased the amount of trade over non-membership tremendously. Whilst this figure was deemed implausible, it supported the hypothesis that the currency union effect on West African trade was positive and significant this is in line with the findings of Rose and Glick (2002) and Adam (2005) and comparable to previous results found using a global sample.
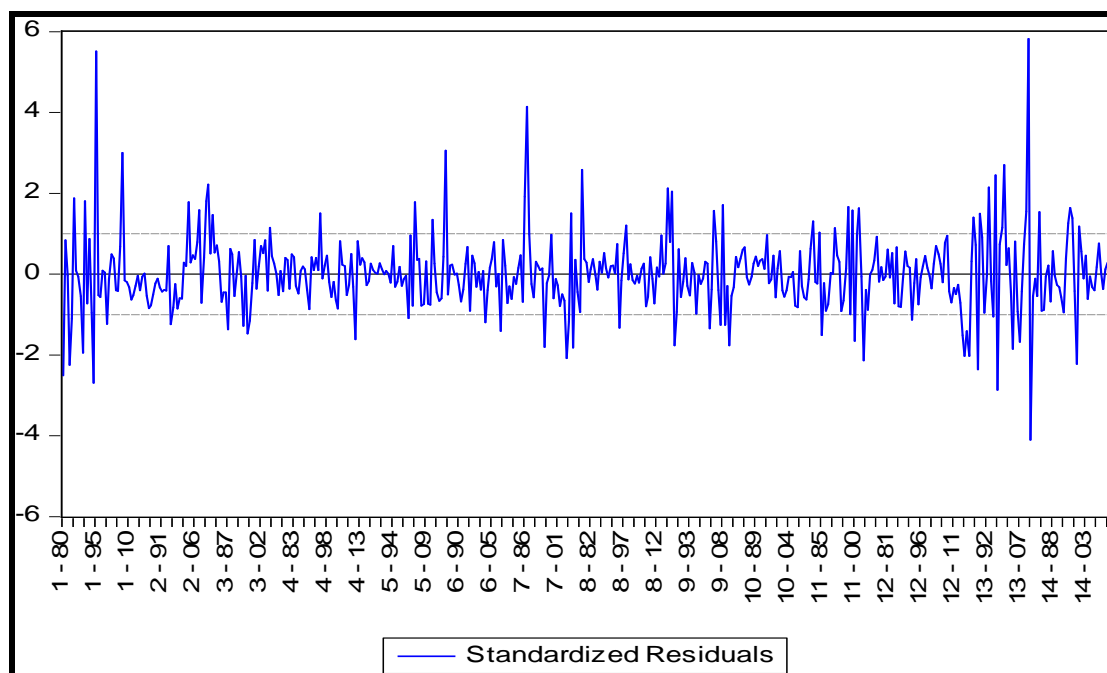
Finally, policy implications regarding these findings indicate that population growth is risk-free to the decision on currency union. The only proportion of growth in population that contributes to the connection between currency unification and trade is growth of active population of the area. Trade is another huge benefit in return for this union in the West African area. Therefore, policy reform on currency union in West African area is a panacea to the raging years of underdevelopment in the zone.

APPENDICES

APPENDIX 1: The Normality Chart

Series: Standardized Residuals Sample 1980 2013 Observations 476	
Mean	-1.05e-15
Median	-1.811613
Maximum	111.0707
Minimum	-61.21354
Std. Dev.	16.95952
Skewness	1.532235
Kurtosis	11.58715
Jarque-Bera	1648.749
Probability	0.000000

APPENDIX 2: The Standardized Residual Graph

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