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BUSINESS CYCLE SYNCHRONIZATION AND THE PROPOSED MONETARY UNIFICATION IN WEST AFRICA: AN APPLICATION OF FAVAR MODEL

Ibrahim Nurudeen — *PhD Research Scholar, Department of Economics, The New College (Autonomous), University of Madras, Chennai, Tamil Nadu, India*

A. Abdulrahim — *Associate Professor, Department of Economics, The New College (Autonomous), University of Madras, Chennai, Tamil Nadu, India*

KEYWORDS:

currency union, business cycle, trade openness, GDP

ABSTRACT

This study analyses the feasibility of going ahead with a formation of currency union proposed by the ECOWAS[1] members to be launched in 2020. This study utilizes annual data, namely, annual GDP growth rate, GDP at current prices and GDP at constant prices from 1980 to 2015 for 13 West African Countries, and a factor augmented vector autoregressive model (FAVAR) is being utilized to accomplish this task. The finding of the study reveals that the West African countries exhibit similarity in terms of response to the same shock and contribution to fluctuation on macroeconomic variables. Thus, this study suggests that the ECOWAS can go ahead with the currency unification as the region satisfies some of the conditions for an Optimum Currency Area (OCA).

1.0 INTRODUCTION

Studies have emerged, investigating the feasibility of forming a regional currency sequel to the study by Mundell (1961) and McKinnon (1963). These pioneering works in this area have highlighted the criteria needed to be fulfilled for a successful migration to an Optimum Currency area (OCA). The criteria are similarity of shocks and business cycle, trade openness, labour 'factor and mobility as well as fiscal and geo-political similarity. The advantages of regional currency among two or more countries include reduction of exchange rate, greater transparency of prices which in turn encourages competition and efficiency, increase in monetary and fiscal policy disciplines, lower inflation and interest rate. However, the cost of forming a currency union is mostly associated with the loss of monetary policy control by the country's monetary authority.

Many empirical studies have been conducted in this area few studies are, Bayoumi and Ecihengree(1994), Nielson and Zouhon-Bi (2007), Loureiro, Martins and Ribeiro(2010), Vieira and Vieira(2012), Dromond etal(2015), Chuku(2012), etc. The Economic Community of West African States (ECOWAS) signed an agreement to launch a single currency by 2020, comprising of 15[2] West African countries. Out of the 15 West African Countries, eight[3] countries belong to the West African and Economic Monetary Union (WAEMU) and these countries have been using a single currency since 1945. What remains is for the other countriesto join them and eventually form a single currency for the whole region called *Eco*.However, in what has been described as their quest to lay a solid foundation for a sustainable monetary union, the member countries have twice postponed the take-off date for the single currency in the West African Monetary Zone(WAMZ)[4] due to non fulfillment of the prescribed criteria. These convergence agenda include inflation rate, fiscal deficit level, central bank deficit and financing of gross external reserves. In his assessment of the performance of the countries in fulfilling the convergence agenda in 2012, the Director General of the West African Monetary Institute said none of the countries had achieved the targets given to them and therefore, urged all the countries to comply in the shortest possible period of time. The latest meeting of the ECOWAS heads of states was in the Republic of Niger on 26th October, 2017, where his Excellency the President of Nigeria, expressed his concern over the continuous disparity of economic fundamentals among the member countries, and expresses fear that with this kind of development, it will be difficult for them to realize the formation of the currency by 2020. He therefore advices that a Committee of Experts should be formed once again to review the agenda while taking into cognizance the lessons bedeviling the European Union(EU).

Similarity of shocks or business cycle ensures co-movement among the nations and is an important factor which is fundamental to achieve successful single currency unification. It is important that all countries have a similar pattern of business cycle. This is because when a single currency is formed; all the member countries will have the same monetary policies and targets. Two contradicting policies will not be possible at a time. As such, investigating whether

or not these countries possess a quality of being in an optimum currency area is of paramount importance. Huh, Kim,Kim and Park(2014), conduct a similar study related to Asian countries and have their finding in favour ofa single currency in the region. Baglio and Morana (2009), conduct a study on international co-movement in US, UK, Japan and Euro Area, where they find evidence of co-movement in the regions. For more studies on business cycle and co-movement see Sims(1980), Eichenbaum and Singleton (1986), Shapiro and Wattson (1998),Blanchard and Fisher(1991), Stock and Watson(2002), Del Negro and Otrok(2008).

Few studies have been conducted relating to the viability of West African currency unification, for example, Chuku(2012), Ekong and Onye(2012), both of whom find that the single currency in West Africa is not feasible due to asymmetries in shocks. Both studies use structural VAR model which has a problem of limited information, which is the main problem that lead to the prize puzzle in the US in 1992. Thus, to improve on this methodology, this study uses a Factor Augmented VAR, where we extracted factors from a large data set. Thus, the objective of this study is to find out the feasibility or viability of a single currency in West Africa by observing the nature of synchronization or co-movement of these countries. A uniform synchronization makes it feasible to go ahead with the unification of the currency. Therefore, this paper, discusses the business cycle synchronization in West African countries.

1.2 THEORETICAL FRAMEWORK

Business cycle can be looked at from different Economic schools of thoughts. Economics as a discipline gained independence from other disciplines through the works of the classical. In the classical model, which is the oldest school of thought believed that deviation of output from its long-term trend is a permanent situation, thus, this is caused by a decrease in aggregate supply in the economy. The decrease in aggregate supply is believed by the classical school to be the result of government activities through taxations and other policies. The depression of the 1930's lead to the upheaval of economic activities in Europe, and the phenomenon that lead to depression couldn't be explained by the classical school. Keynes rose to fame as he offered an explanation and, also a solution to the phenomena and hence advocated for government intervention. Keynes first criticized the classical's labour market on their assumption of full employment and flexible prices. He advocated for the opposite of both assumptions. In a Keynesian economics, a cycle sets in as a result of activities of the speculators in the economy which results in plunging of stock prices and investment. This in the long run will affect income, and lower income will make households to cut their expenditure and finally affects aggregate demand.

1.3 EMPIRICAL FRAMEWORK

VAR model has been criticized on two grounds. First is the dimensionality problem, which means that only few variables can be included in VAR analysis. Thus, the VAR estimates and impulse response functions can only be able to capture the dynamics of those variables included in the system, therefore to estimate the model, few variables need to be included. As such, there will be an issue of limited information which lead to the problem of price puzzle as uncovered by Sims(1992). The second problem is related to estimates, which are without an economic meaning. Now to address the issue of economic meaning SVAR models were developed. See Blanchard and Qua (1989), Gali (1992), Gottschalk(2001), Abubakar and Jorthi (2016), Fatas and Mihov (1998), Perroti (2004), Kilian (2011), Ouliaris, Pagan and Retrespo (2016) and Pfaff and Taunus (2008), Blanchard and Perroti (2002), etc. SVAR models could not solve the problem of limited information associated with VAR in addition to the problem of ordering of the variables and shock identification. To solve these problems, a FAVAR model was developed. Factor models in time series were first introduced by Sergent and Sim(1977), and Geweke (1977), popularized by Stock and Watson(1999), where they used the model to forecast inflation using over 100 series. Bernanke, Boivin and Elias (2005) expanded this modeling to VAR framework. The most striking value added to this literature is that they allowboth the observable and non-observable factors to follow a VAR process. The FAVAR model allows a researcher to extract factors from large macro-economic variables, in such a way that there is hardly a failure to capture any information in the system. For more survey on FAVAR literature see Bernanke and Boivin (2001), Stock and Watson (2002), Stock and Watson(2005a), Stock and Watson(2005b), Bernanke Boivin and Elias(2005), Ekmeier and Breitung(2005), Ekmeier(2007), Stock(2008), Del Negro(2008), Ahmadi and Rischl(2009), Bagliano and Morana (2009) Watson (2010), Gabor(2012), and Huh, Kim, Kim and Park(2014), etc.

1.4 DATA AND STRATEGY

The methodology of this study follows the work of Baglio and Morana(2008), and Huh, Kim, Kim, and Park(2014). The study utilizes annual data for 13 West African countries from 1980-2015. Guinea Conakry and Cape Verde are excluded from the study due to non-availability of a complete observation necessitated for the study. The study finds out the response of each country's real GDP on regional shocks. The use of output as a single series in the study of business cycle can be found in Stock and Watson(2005b) and Sato and Zhang(2005). In order to satisfy the criteria that factors extracted will be more reliable if the cross-section N is greater than observation T, as in Bai and Ng(2002), The study also includes 2 more series of output, i.e. Current and Constant output series. While this is to satisfy the above condition and also, to enable the factors extracted to fully represent output. Extracting factors from stationary series is a pre-condition, thus the series are converted to stationary and re scaled before extracting the factors. Therefore, to understand the application of FAVAR, consider the equation below given by Bernanke, Boivin and Elias(2005), they assume that the joint dynamics of F_t and Y_t gives the following equation

$$\begin{bmatrix} F_t \\ Y_t \end{bmatrix} = \bar{}(L)\begin{bmatrix} F_{t-1} \\ Y_{t-1} \end{bmatrix} + v_t \quad \ldots\ldots\ldots\ldots\ldots (1.4)$$

Y_t is a vector of observable macroeconomic variables and F_t is Kx1 vector of unobservable factors. Observables are those variables we can directly observe, while unobservable factors are those series that cannot be measured but has to be represented by the factors, for example, output gap does not have a series which can be used to measure it. $\bar{}(L)$ is a lag polynomial of finite order d, while v_t is a random disturbance term with zero mean and covariance Matrix $\sum$. Relating to the term qualifies equation (1.4) a FAVAR, else if the term is zero, equation 1.4 will be reduced to a standard VAR. If we relate Xt to be a function of observable vector Yt and unobservable factor Ft, we have the following equation

$$X_t = \Lambda^f F_t + \Lambda^y Y_t + e_t \quad \text{.....(1.5)}$$

Where Λ^f is N x K matrix of factor loadings, Λ^y is N x M, and e_t is N x 1 vector of random disturbance term, with zero mean. Thus, equation 1.5 indicates that both Y_t and F_t are the forces behind the dynamics in Xt To find out how the countries respond to common shocks we assumed the following relationship between reduced form and structural form errors.

$$V_t = A^{-1} B\, e_t \quad \text{.....(1.6)}$$

Where A is a MxN matrix of the coefficients of C($F_t Y_t$) measuring the response of each country's response to shocks, V_t is the vector of the reduced-form shocks, B is an MxK of the variance-covariance matrix and e_t is a vector of the structural shocks. We need to impose 2k2-k(k-1)/2 restrictions in order to identify equation 1.6 which will allow us to retrieve the impact of various shocks on the structural parameters. There are many ways of imposing restrictions in VAR literature. The restriction can follow a Wold(1969) procedure, it can also be a procedure by recursive as suggested by Sims(1980). Other forms of restrictions include theoretical restriction, sign restriction as well as restriction by hetroskedasticity. Thus, this study employs a recursive identification procedure. Where A matrix is a diagonal matrix and B is a lower triangular matrix which measures contemporaneous response and structural shocks respectively as shown below:

$$A = \begin{bmatrix} 1 & 0 & 0 \\ 0 & 1 & 0 \\ 0 & 0 & 1 \end{bmatrix} = \qquad B = \begin{bmatrix} a_{11} & 0 & 0 \\ a_{21} & a_{22} & 0 \\ a_{31} & a_{32} & a_{33} \end{bmatrix} \quad \text{.....(1.7)}$$

1.5 EMPIRICAL RESULT AND DISCUSSION

In this session, we present the empirical results and findings of the study.

Table 1: Common and Individual Averages of GDP

	BE	BK	CO	GB	GM	GH	LIB	MA	NR	NG	SL	SE	TG
Aver.	4.05	5.05	2.33	2.45	3.35	4.60	1.2	3.92	2.81	3.52	2.38	3.4	2.46
Med.	4.27	5.75	1.6	3.20	3.54	4.7	0.3	3.63	3.07	4.03	3.72	3.7	2.99
Max.	9.9	11.	10.	18.1	10.8	14.	106.	20.2	11.8	33.7	26.2	7.8	14
Average Value for the whole sample 3.205882													
Medium Value for the whole sample 3.782291													

Source: computed

Table 1 presents the common and individual average annual growth rate of GDP's. The average growth collectively for the region is 3.205, which means the average annual growth rate of GDP is 3 percent. However, most of the countries are revolving around the mean. Liberia is the only country with the lowest average growth of 1.2 percent; this means that Liberia has the lowest growth rate in Africa. This is not surprising considering the long period of civil war that permeated the country for over seven years; this has seriously degraded economic activities of the country with dilapidated and shabby infrastructure. Cote d'ivoire, Guinea Bissau, Niger Republic, Sierra Leone and Togo are also countries that have anaverage annual growth less than the common average growth rate. All the countries in this group belong to the WAEMU or CFA zone, this might be the reason for their similar growth rate since there is likely to have a kind of dragging effect of smaller economies by the bigger economies. Sierra Leone, like Liberia had civil war that lasted for almost 10 years from the 90's until early 2000. This has undoubtedly caused a sluggish movement of the economy, which instead of investing for development, they were investing as a means of reconstructing the country devastated by the war. The remaining countries all have an overwhelming growth rate vis-à-vis the region's average growth rate, with Burkina Faso having the highest average growth rate of 5.05. It is a country that is heavily dependent on agriculture with cotton as the highest cash crop. In the same vein, availability of gold in the country has attracted commendable foreign and local investment which helped facilitated the economy's growth.

Table 2: Contemporaneous Responses to Common Shocks.

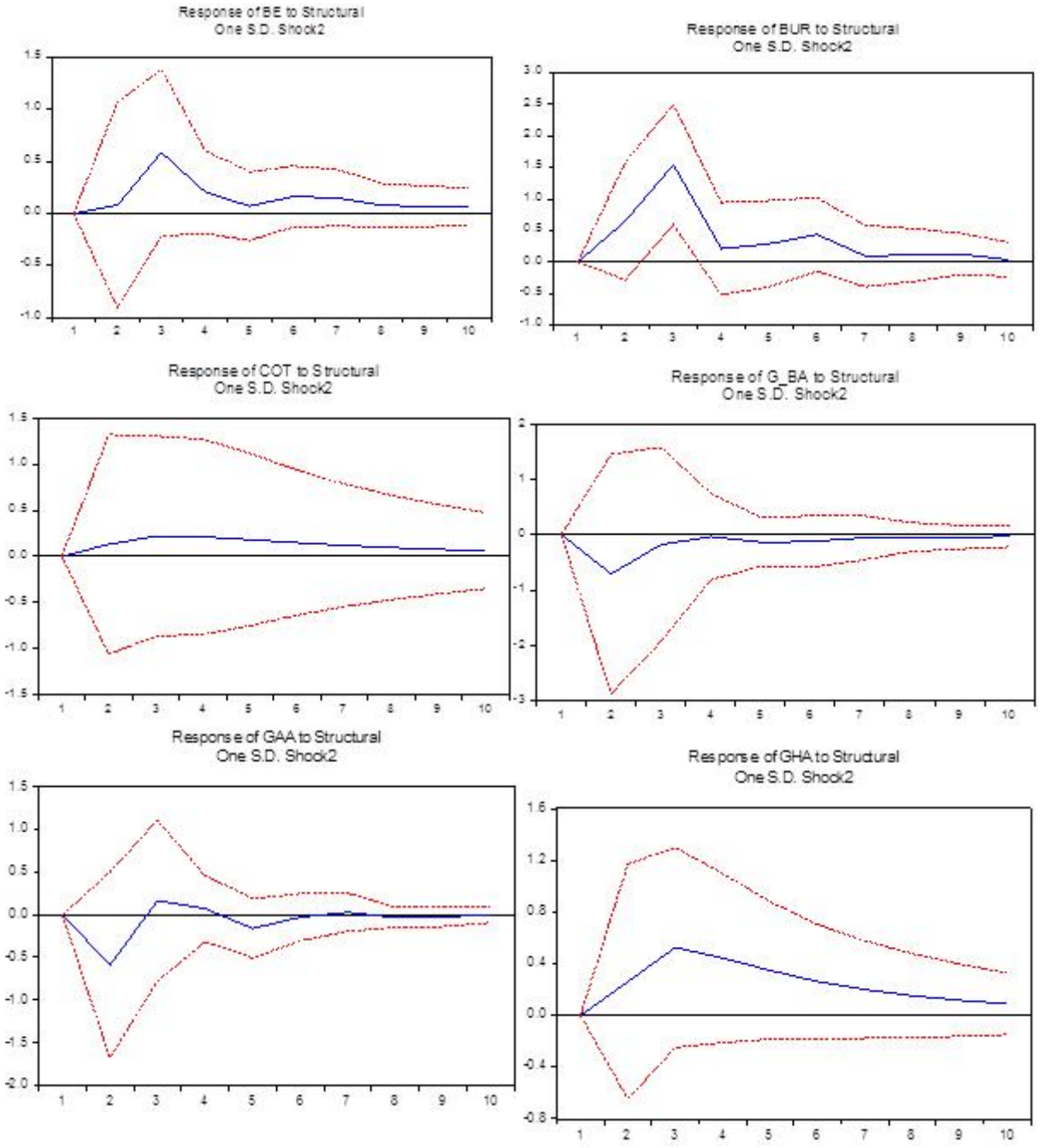
Variables	Coefficient(s)	Variables	Coefficient(s)
Benin	-0.061(0.052)	Mali	0.064(0.054)
Burkina	0.054(0.310)	Niger	0.114(0.054)
Cote d' Voire	0.052(0.050)	Nigeria	0.025(0.054)
Guinea Bissau	0.022(0.052)	Sierra Leone	-0.088(0.055)
Gambia	0.059(0.052)	Senegal	0.050(0.055)
Ghana	-0.064(0.055)	Togo	0.109(0.054)$
Liberia	0.012(0.055)		

Source: Computed

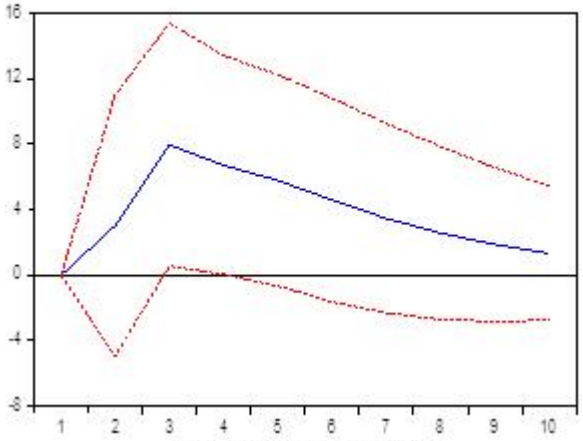
Table 2 presents the contemporaneous responses of the regional GDP's to a common factor shock. This mechanism helps us to assess the symmetry or asymmetry of shocks in the regions. One of the factors that will guarantee a successful and continuous unity of the intended union is similarity in terms of the shocks. Once countries react differently to an exogenous shock in the region, it means they fail to be good candidates of a monetary union. To ascertain the candidacy or otherwise of the countries, we assess the impact of the shock through an impulse response mechanism.

We assume that all the countries will have a similar response in terms of a common factor shock, and our common factor here, is the regional GDP. The above table contains the response of each region on the common GDP shock contemporaneously or instantaneously. When a one standard deviation shock is given to our factor, almost but by mean all the countries exhibit a positive response. The only exceptions are Benin, Sierra Leone and Ghana. This means that out of 13 countries under study, only 3 countries have a different response from the entire sample. The negative sign of Sierra Leone might not be unconnected with the 11 years long civil war in the country which left many people unemployed with sluggish economic activities in the period. However, Benin is one of the smallest nations of West Africa with only a GDP of about 8 billion dollars. Thus, it might not be a threat to the union. Ghana which is one of the most important countries in West Africa, had a long history of economic crises which engulfed the economy in the 1990's until the 2007 when the country successfully demonetized its currency. The outcome of the contemporaneous responses of the countries to common shocks displays to a larger extent similarity of response to shock among the countries lending a support in favor of the monetary union.

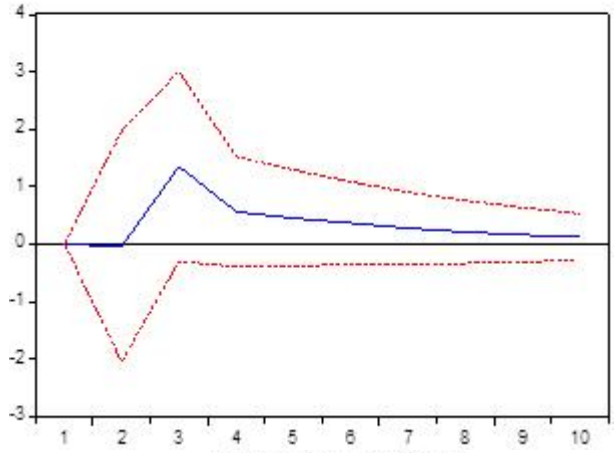
Figure 1: Impulse Responses for 10 horizons .



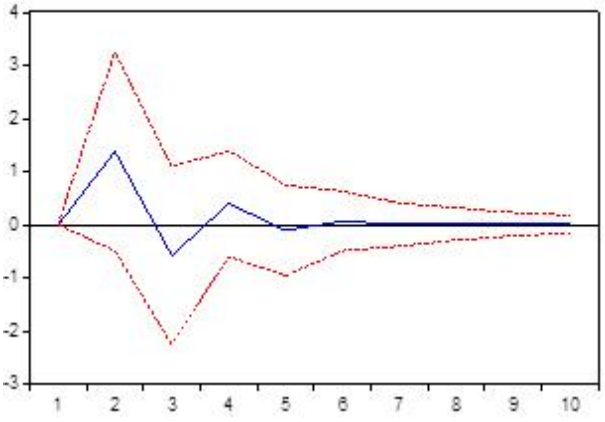
Response of LIB to Structural
One S.D. Shock2



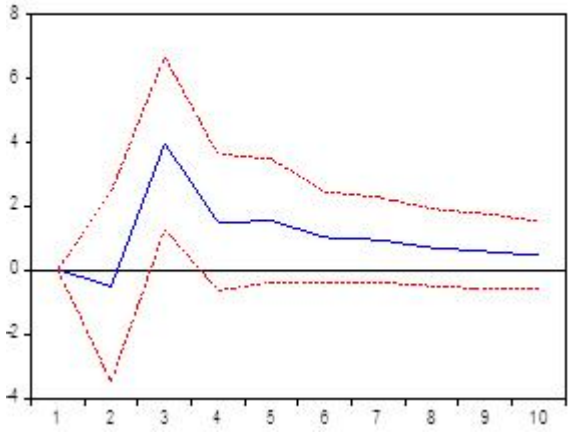
Response of NGRA to Structural
One S.D. Shock2



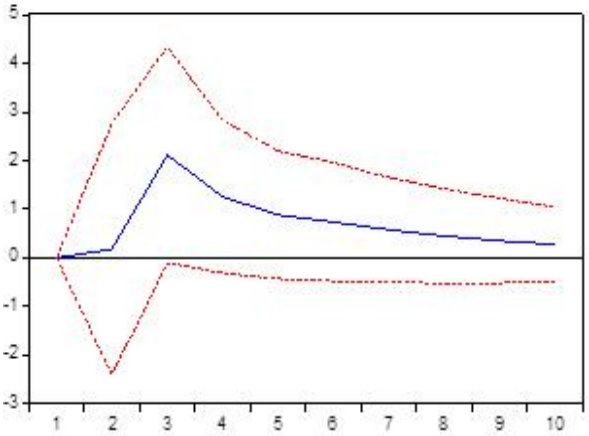
Response of MA01 to Structural
One S.D. Shock2



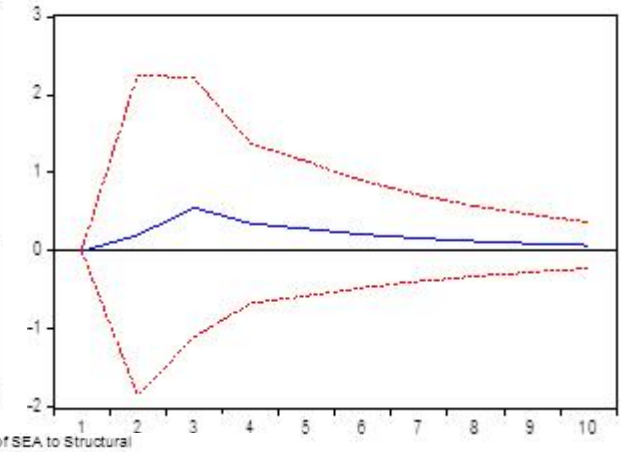
Response of S_LO to Structural
One S.D. Shock2



Response of NIGA to Structural
One S.D. Shock2



Response of TOG to Structural
One S.D. Shock2



Response of SEA to Structural
One S.D. Shock2

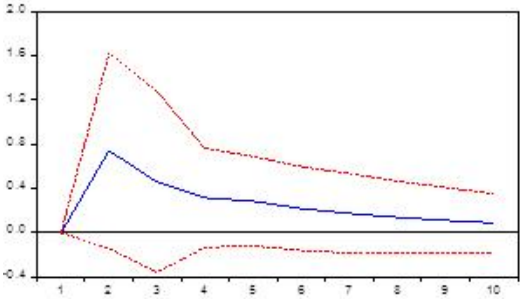


Figure 1 is the forecasted period of shocks for 10horizons of all the countries. In the contemporaneous responses, we have a majority of the countries having a similar shock, meaning that, there is evidence of symmetric responses among the countries. Our task in this section is to find out whether or not there is a change in the above evidence after a certain period of time. Sierra Leone, Ghana, and Benin who were having negative shock contemporaneously, appeared to have a positive shock throughout the forecasted period as in the case of Ghana and Benin, whereas Sierra Leone turned out positive after the second horizon. Thus, the overall evidence is that almost all the countries behave similarly. Connotating that all the countries responded positively throughout the forecasted horizon, except Gambia and Guinea Bissau. Though these two have a negative beginning but the scenario changes towards the end of the period. The outcome of the shock, however, reveals that the countries under study have a great sense of similarity in terms of response to shock, thus lending more support to formation of a regional currency.

Table 3: Variance Decomposition

Country	Share of Fluctuation	Country	Share of Fluctuation
Benin	0.088	Mali	6.594
	4.451		8.025
Burkina	5.79	Niger	0.004
	27.20		6.770
Cote	0.100	Nigeria	0.065
	0.602		10.81
Guinea Bissau	1.300	Sierra Leone	0.375
	1.280		20.52
Gambia	3.487	Senegal	8.205
	3.388		12.02
Ghana	0.967	Togo	0.130
	7.098		1.445
Liberia	1.710		
	17.86		

Source: Computed

The variance decomposition as reported in table 3 helps us to assess the relative share ofeach country in terms of the fluctuation as a result of the impulse responses. Due to space limitation and consensus of the business cycle literature, that cycles last for no more than 4 quarters, we observe only the second and fourth horizons. In the second horizon, countries with very low contribution to fluctuation in the macroeconomic variables are Benin, Niger, Nigeria, with 0.088, 0.004 and 0.065 respectively. This is not surprising because Nigeria, is having adirect link with Niger and Benin. 80 percent of Nigeria's used cars are imported from Benin, where Nigerians feel it is cheaper to receive their imported goods. Similarly, more than 10 million Nigeriens live in Nigeria, this shows the extent of interdependence between these nations. Another group whichhas the next lowest contribution to fluctuation in the region comprises of Cote d'ivoire, Sierra Leone, Togo, Ghana, Liberia and Guinea Bissau with each having a contribution of fluctuations to the tune of 0.100, 0.375, 0.130, 0.967, 1.70, and 1.300 respectively. These countries except Ghana and Liberia belong to CFA zone. It is not surprising for these countries to have a similar response in terms of contribution made to the macroeconomic fluctuations because they are all francophone countries using the same currency under a single central bank and, to a larger extent, having similar direction in terms of fiscal policy targets. Countries with high contribution in the fluctuation are Mali, Gambia, Burkina Faso and Senegal. Except Gambia these countries are CFA zone participants notwithstanding the fact that Gambia and Senegal are close allies and have a common language and movement of labour and capital between the two countries. In the fourth horizon, most countries buy by no means all the witnessed increase in share in the fluctuation, with Burkina Faso, Sierra Leone and Liberia having the highest contributions. These countries are the only countries with a long history of civil war which made them distinguishingly different from other West African countries. In retrospect therefore, going by each countries contribution with very no country having more than 30 percent contribution in the fluctuation, we will argue in support of proceeding with the formation of a monetary union and a single currency.

The findings support the formation of a West African currency called the *Eco* as proposed by the ECOWAS by 2020 and coincide with a similar finding in Asia by Huh, Kim, Kim, and Park(2014), Vieira and Vieira(2012). However, Chuku(2012) in his study on whether West Africa should go ahead with a single currency or not, have findings which are divergent in relation to the formation of the currency and has recommended that it is not yet time to kick off the project.

1.6 CONCLUSION

The main objective of this study was to find out the viability of currency unification in West Africa using a FA-SVAR approach. It is conducted for ECOWAS region which has 15 members which propose to launch a single currency by 2020, but due to inadequacy of the data Guinea Conakry and Cape Verde are dropped out of the equation. It could be deduced from the result and discussion of that, this study supports the argument in favour of single currency in the region. This means that the region will likely witness a better and strong economic growth having exhibited a similar movement in terms of the business cycle of output.

REFERENCES

1. *Bernanke S. and Boivin J. (2001) " Monetary Policy in a Data Rich Environment"*
2. *Knoop A.T.(2015) "Business cycle Economics: Understanding recessions and Depressions from Boom to Bust".*
3. *Ekong C.N. and Onye K.U.(2012) " on the feasibility of a common currency in West Africa: Evidence from Multivariate SVAR."*
4. *Loureiro J., Martins M.M.F., Ribeiro A.P. (2010), "Anchoring to the Euro and Grouped together? A case of Frican Studies"*

5. Chuku A. C.(2012), the proposed Eco: should West Africa proceed with the common currency?"
6. Horvath R. and Komarek L.(2002). " Optimum currency theory Area: An approach for thinking about monetary integration"
7. Drummond etal(2015), " Towards a Monetary union in East African community, asymmetric shocks, Exchange rate, and Risk sharing mechanisms."
8. Vieira C and Vieira I.(2012), " Monetary Integration in eastern and southern Africa: choosing a currency peg for COMESA" CEFAGE-UE working paper.
9. Nielson L. and Zouhon S.G.(2007) "Fiscal Revenue Implication of the prospective Economic partnership agreement with the EU. Africa Region Working Paper Series No. 103 April 2007
10. Bayoumi T. and Echengreen B.(1994) " one money or many? Analyzing the prospects for monetary unification in various parts of the world" Princeton studies in international finance No. 76.
11. Stock J. H. and Watson M.W (2008) "forecasting in Dynamic factor Models Subjects to Structural Instability"
12. Del Negro M. and Otrok C.(2008) "Dynamic Factor Models with Time-Varying Parameters: Measuring Changes in International Business Cycles. Federal Reserve Bank of New York Staff Report.
13. Eckmeier S. and Breitung J. (2005), "How synchronized are Central and East European Economies with the Euro area? Evidence from structure factor model" Discussion paper Series one 1, Economic studies No. 20
14. Pellényi, Gábor (2012) : The sectoral effects of monetary policy in Hungary: A structural factor analysis, MNB Working Papers, No. 2012/1
15. Bernanke and Boivin (2001) "Monetary Policy in a Data rich Environment" Working paper 8379 National Bureau of Economic Research.
16. Bernanke B.S. Boivin J. and Elias P. (2005) "Measuring the effect of monetary policy: A factor –Augmented Vector Autoregressive (FAVAR) Approach"
17. Stock J. H. and Watson M. W (2010). "Dynamic Factor Models"
18. Ekemeier S. (2007), "Co-movement and Hetrogeneity in the Euro Area analysed in a Non Stationary Dynamic Factor Model
19. Huh H., Kim D., Kim W. J., Park C.Y(2014), "A factor augmented Vector Autoregressive Analysis of Business cycle Synchronization in East Asia and Implications for a Regional Currency Union. ADB Economics working paper Series.
20. Bagliano F.C, and Morana C. (2008), " International Macroeconomic Dynamics: A Factor Vector Autoregressive approach
21. Kose A.M.,Otrok C., and Whiteman C.H.(2003). "International Business Cycle: World, Region, and country specific factors.
22. Sato K. and Zhang Z.Y.(2005), "Real Output co-movement in East Asia: A co-integration Approach"
23. Stock J.H. and Watson M.W.(2002), "forecasting Using Principal Components from a large Number of predictors.
24. Stock J.H. and Watson M.K. (2005b), "Understanding Changes in International Business Cycle Dynamics" Journal of the European Economic Association."
25. Stock J.H. and Watson M.K. (2005a), Implications of Dynamics Factor Models For VAR Analysis. NBER working Paper Series.
26. Kose A.M.,Otrok C., and Whiteman C.H.(2005), "Understanding the revolution of World Business Cycles". International Monetary.
27. Blanchard O.J and Quah D. (1989), "The Dynamic effects of aggregate Demand and Supply Disturbance"
28. Gali J.(1992), "How Well does the IS-LM model fit postwar U.S Data" the Quarterly Journal of Economics"
29. Abubakar J. and Jorthi S.(2016), Monetary Disturbance in Nigeria: What Puzzles ? Price or output. Unpublished.
30. Gottschalk J.(2001), " An introduction in to SVAR methodology: Identification, interpretation and limitations of SVAR models. Kiel working paper No.1072
31. Fatas A. and Mihov I.(1998), " the effect of fiscal policy on consumption and employment: theory and evidence.
32. Perroti R.(2004), " Estimating the effects of fiscal policy in OECD countries" working paper series no. 276.
33. Kilian L. (2011). " Structural Vector Autoregressions" international macroeconomics.
34. Pfaff B. and Taunus K. (2008), " VAR, SVAR, SVECM models: implementation within R package vars
35. Ouliaris S., Pagan A.R., and Restrepo J.(2016)." Quantitative Macroeconomic modeling with Structural Vector Autoregression. An Eviews implementation.
36. Sims C.(1980), "Macroeconomic and Reality" Econometrica vol.48. no.1
37. Bai and Ng(2002), "Determining the number of factors in approximate Factor Models"

End notes

[1] Stands for Economic Community ofWest African States formed in 1975.

[2] The countries include, Nigeria, Niger, Mali,Togo, Senegal, Sierra Leone, Liberia, Cote d'ivoire, Benin, Gambia, CapeVerde, Ghana, Burkina Faso, Guinea Bissau and Guinea Conakry.

[3] Niger, Cote d'ivoire, Mali, Senegal, Guinea Bissau,Togo, Benin, Burkina Faso.

[4] Stands forWest African Monetary Zone, comprising countries other than the old French colonies.