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Assessing the feasibility of monetary union in terms of business cycle synchronization in West Africa: An Application of Factor Augmented Vector Autoregressive Model (FAVAR)

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ABSTRACT: *This paper examines the nature of business cycle synchronization among 14 West African countries. Six macroeconomic variables were selected from each country and 4 regional shocks were identified that include regional output shock, regional exchange rate shock, regional monetary policy variable shock, rest of the world shock, and two external shocks from crude oil prices and World GDP. A factor Augmented Vector Autoregressive Model (FAVAR) was employed to achieve the objectives of the study and data used in the analysis spanned from 1980 to 2016. The result from the impulse response function reveals the evidence of similar response to the same shock among majority of the countries at different horizons. The business cycle synchronization was examined through each country's contribution to fluctuation at the forecasted error, however, the result indicates that majority of these countries are synchronous and the success of the currency could not be ruled out. Thus, the study concludes in favor of single currency.*

Key Word*: Monetary union, Economic Community of West African States, Optimum Currency Area, Factor Augmented Vector Autoregressive, monetary policy,* business cycle

I. INTRODUCTION

In a monetary union, it is important to have a sound and a clear agreement before the take off; this implies that it is not only about theoretically written agreements, but agreements in terms of the co-movement of the members, which can only be ascertained empirically. It is imperative to note that when countries come together to form a monetary union, each member of the union will give up its monetary powers to the harmonized central bank. In such a union, a single monetary policy will be adopted for the entire region. That is to say, that no member country will be allowed to pursue an independent monetary policy as this is no longer possible since, in an economy, it is impossible to maintain two counter policies. In this background in mind, it is important for us to make an empirical examination, assessing the feasibility of such union in terms of business cycle synchronization, the business cycle has different phases, which include recession and boom among others. When one country is in recession while some other countries are in boom or at the peak, it becomes tough to maintain such difference as in the case of Greece in the European Union. That means, we cannot have policies target recession, and boom at the same time, this often lead to failure of the union. In order to avoid such setbacks and remorse, we undertake studies to find out if these countries will have similar movement, and if the response to different shocks will also be similar. Thus, the union will also be successful if the shocks sometimes can be engrossed by the greater countries, thereby saving the smaller ones. In the case of our own study, we have two different blocks that share a common geographical location but are divided in terms of colonial history and language.

As a result, there is need for us to find out how far these countries can move together before the actual take off; this will help to avoid all problems that may arise as a result of differences. Robert A. Mundell [1] and Mckinnon [2] studies investigate the feasibility of forming a regional currency consequence highlighted the criteria needed to be fulfilled for a booming migration to an Optimum Currency Area (OCA). The criteria are resemblance of shocks and business cycle, trade directness, labour factor and mobility as well as fiscal and geo-political similarity. The advantages of regional currency among two or more countries comprise reduction of exchange rate, greater transparency of prices which in turn encourage competition and effectiveness, increase in monetary and fiscal policy disciplines, lower inflation and interest rate. Though, the cost of forming a currency union is mostly related with the loss of monetary policy control by the country's monetary authority.

Moreover, many empirical studies have been conducted in this area for example Simplice G. Zouhon-Bi and Lynge Nielsen [3], João Loureiro, Manuel M.F. Martins, Ana Paula Ribeiro [4], Carlos Vieira, Isabel Vieira [5], Paulo Drummond (etl) [6], Chuku, Chuku [7] etc. The Economic Community of West African States (ECOWAS)[1] 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. Though, what remains is for the other countries to join them and eventually form a single currency for the whole region called *Eco. C*onversely, in what has been described as their quest to lay a solid foundation for a sustainable monetary union, the member countries have twice deferred the take-off date for the single currency in the West African Monetary Zone[4] (WAMZ) due to non-fulfillment of the prescribe criteria.

Still as, these convergence agenda consist of 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 (DGWAMI) said none of the countries had achieve the targets given to them and therefore, urge all the countries to observe in the shortest possible period of time. The latest meeting of the Economic Community of West African States (ECOWAS) heads of states was in the Republic of Niger on 26th October, 2017, where his Excellency the President of Nigeria, articulated his concern over the continuous disparity of economic fundamentals among the member countries, and express 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).

Resemblance of shocks or business cycle ensures co-movement among the nations and is an essential factor which is basic 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. Likewise, two contradict policies will not be possible at a time, as such, investigate whether or not these countries acquire a quality of being in an optimum currency area is of paramount importance. Hyeon-seung Huh, David Kim, Won Joong Kim, and Cyn-Young Park [8] perform a similar study associated to Asian countries and have their finding in favour of a single currency in the region. On the other hand Christopher A. Sims [9], Matthew D. Shapiro, and Mark W. Watson [10], James H. Stock and March M. Watson [11] and Marco Del Negro and Christopher Otrok [12] conduct a study on international co-movement in US, UK, Japan and Euro Area, where they find evidence of co-movement in the regions. As well, few studies have been conducted concerning to the viability of West African currency unification, for example, Chuku, Chuku [13] and Ekong, Christopher N and Onye, Kenneth [14] both of whom find that the single currency in West Africa is not feasible due to asymmetries in shocks. Both studies use structural Factor Augmented Vector Autoregressive (FAVAR) model which has a problem of limited information, which is the main problem that lead to the prize puzzle in the US in 1992. Accordingly, to improve on this methodology, we use a Factor Augmented Vector Autoregressive (FAVAR), 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 observe the nature of synchronization or co-movement of these countries and uniform synchronization make it feasible to go ahead with the unification of the currency.

II. THEORETICAL AND EMPIRICAL REVIEWS OF LITERATURE

Theoretical Review: 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 an enduring situation, thus, this is caused by a decrease in aggregate supply in the economy. The decrease in aggregate supply is assumed 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 disturbance 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 advocate for government intervention.

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

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

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

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

Keynes first criticized the classicalist labor market on their assumption of full employment and flexible prices. He advocate 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.

Empirical Review: The literature on the advantages of a monetary union evolve development to the research of Bayoumi, Tamim, and Barry Eichengreen [15], Roman Horvath And Lubos Komarek [16], Simplice G. Zouhon-Bi and Lynge Nielsen [17] and Olanrewaju [18] etc., the Optimum Currency Area (OCA) requires that before a region could be qualified for such unification, there should be present some features, these consist of similarity in business cycle, trade openness, labour factor and mobility as well as fiscal and geo-political similarity. When a region is qualified as an optimum currency area, there are certain advantages that all the parties engage in the treaty will benefit from, as a result decline in exchange rate, greater transparency in prices, which will persuade competition and efficiency, in this manner eradicate externalities, reduction in inflation and interest rates among others. On the other hand, the unification is not free from disadvantages, which is the loss of monetary authority and policy control.

At present, a number of regions are using a single currency; the oldest ones are the two Communaute Financiere Africaine (CFA) regions. The former French colonies in West and East Africa have been using a single currency since 1945, which are guaranteed by the French treasury. They are theoretically two separate currencies but have always been maintaining similar value. The West African (XOF) known in French as Communaute Financiere Africaine (CFA) or Financial Community of Africa (FCA) is in use by its members known as Union Economique et Monetaire Ouest Africane (UEMOA) and it stand for West African Monetary Union. The West African Communaute Financiere Africaine (CFA) is jointly shared by eight[5] countries in the region and the currency are issued directly from its Central Bank located at Dakar, Senegal. The other twin Communaute Financiere Africaine (CFA) is used by six[6] Central African Countries. What differentiate it from the other Communaute Financiere Africaine (CFA) is that the codes denote as (XAF), and the currency is issued by Banque des Etats de l'Afrique Centrale known as the Central Bank of East Africa located in Yaoundé, Cameroon. These six countries are bounded by an economic union known as Communauté Économique et Monétaire de l'Afrique Centrale (CEMAC), i.e., Economic and Monetary Community of Central Africa.

Consequently, the West African Communaute Financiere Africaine (CFA) even though issued by the Central Bank of West African States (Banque Centrale des Etats de l'Afrique de l'Ouest –BCEAO), it is operated by the French treasury; this is an obstacle for the region to manage and implement their monetary rights. Correspondingly, most of the African countries in particular the West African and Economic Monetary Union (WAEMU) region have to a larger extent depended on developed nations like the European Union (EU) for foreign aid to fund their budgets, this results in conditional aids and as a result restrict their power to maintain and manage the affairs of their economy.

Moreover, peg of the currency is yet another issue which has been researched by experts pertaining to this region, Carlos Vieira, Isabel Vieira [19] and João Loureiro (etl.,) [20] find in their studies that, the Euro is the right anchor for the region, instead of British Pounds or U.S Dollar. Another dimension that took the notice of researchers in the West African and Economic Monetary Union (WAEMU) zone is the issue of shocks asymmetries, for example, Mohamed Siry Bah [21] find that the effects of structural shocks occurring in the West African and Economic Monetary Union (WAEMU) zone moved out over time and the Gross Domestic Product (GDP) reverted towards their relevant equilibrium, which suggest that currency unification is feasible and promise in the West African and Economic Monetary Union (WAEMU) area.

In the same Harrison Oluchukwu Okafor [22] finds that fiscal policy distortion constitutes serious policy challenge to monetary union in the zone but dealing with such a challenge according to him require only short run systematic macroeconomic adjustment. On the other hand Godfrey C. Uzonwanne [23] argue against the econometric models being used to assess the viability of monetary unification finding the Lucas Critique of 1976 as a backup, he opines that political instrument acting a more very important role in such an measurement rather than simply assume economic factors to be the only bottom line. The second oldest prescribed currency union is the East Caribbean Central Union (ECCU) and East Caribbean Dollar which has been in existence since 1965 and has been in use by seven[7] countries in addition to the Organization of Eastern Caribbean States

[5] Niger, Senegal, Burkina Faso, Ivory Coast, Togo, Benin, Guinea Bissau and Mali.

[6] Cameroon, Central African Republic, Chad, Congo, Equatorial Guinea, Gabon

[7] Dominica Grenada, Montserrat, Saint Kitts and Nevis, Saint Lucia, Saint Vincent and the Grenadines, Anguilla.

(OECS). East Caribbean Central Authority was saddled with apex tasks until 1983 when the Eastern Caribbean Central Africa was introduced. After its concern in 1983, the Eastern Caribbean Central Bank, maintain its place as an apex bank and in view of that was saddle with the responsibility of issuing and regulating the currency in the region. Despite the cases of some countries withdrawing like Guyana, and some joining and re-joining like Barbados, the countries bounded by the single currency in the region remain seven in number.

While, these countries also belong to a union known as the Organization of Eastern Caribbean States (OECS), which is an inter-governmental organization dedicated to economic harmonization and integration, easy way of exchanging goods and services, free movement of labour and capital among others. Like the Cooperation Financiereen Afrique (CFA) and West African Monetary Zone (WAMZ), East Caribbean Currency Union has some issues associated to the currency in the region. Some of these issues are highlighted by the International Monetary Fund (IMF) in their Board of Directors meeting in July, 2016 and revisited in July, 2017. The directors discuss key issues on the Eastern Caribbean Currency Union. They commended the influential relations taken by the authority in the region to make stronger the flexibility of the banking system. They also welcome the passing of the key banking legislation and the successful resolution of the three bankrupt banks. They also commended the swift action taken to clean up the balance sheet of the banks as well as to resume lending to the public. The directors also hinted on the efforts to make stronger the framework for international tax cooperation and for anti-money launder combating the financing of terrorism and that should be compliment by appealing with international partners in order to mitigate the risk of further loss of the Corresponding Banking Relationships (CBR).

Despite the fact that the directors hailed the authority for the progress in fiscal discipline in the region, they emphasize that stronger actions are desirable to achieve the regional debt of 60 per cent of Gross Domestic Product (GDP) by 2030. In particular, they also recommended that a medium term fiscal adjustments and underpinnings with fiscal rules as well as persistent enhancement of public finance management framework be undertaken. In the same way, they also underscore the magnitude of internalizing the costs and national disasters in the fiscal framework and also urge governments to come up with a means of encourage investment by the citizens to improve the sustainability of the fiscal performance. In the same vein, the directors also called for the region to progress international competitiveness by pursue structural reforms that will reduce the cost of doing business etc. One responsibility that every central bank should keep is the ability to manage data and statistics. The board of directors urges the authorities to get better in this regard so that researchers and other policy makers could have easy access to data and accordingly put together various policies for the region's economic growth and prospects.

In addition Ben S. Bernanke, Jean Boivin, Piotr Eliasz [24] has highlighted the successes and challenges of the single currency policy in the region. According to him, the East Caribbean (EC) dollar was fixed at a parity of EC$2.70 to US$1.00, this parity has remained the same for 40 years and has helped in stabilizing the prices in the currency region. There are a lot of ongoing debates in the region to maintain the same parity in order to make confidence and certainty persist in the minds of the citizens. As a result, the parity has undoubtedly promoted stability, assured certainty and confidence in the region. Another success factor, as hinted by the Deputy Governor, is the unanimity rule, which according to him, has helped to maintain the parity formulae in the region. The unanimity rule is the fact that all decisions taken by the monetary committee has to be unanimous and endorsed by all the members.

In spite of these successes, the currency unification is facing enormous challenges and the region is mainly consumption based where the exports stood around 40 percent of its Gross Domestic Product (GDP) with imports only representing 6 per cent of Gross Domestic Product (GDP); this no doubt has a negative impact on the performance of the currency against foreign currencies. In the same way, follow-up to the financial crisis of 2007/2008, the growth rate of the economy has drop down from 5-6 per cent to 2 per cent and a projection of 2 per cent growth rate by the end of 2018. This is not a welcome development because about 5 per cent of the growth rate is necessary on a reliable and sustained basis to double the per capita income in 10 years.

The region is also characterize by high accumulation of debt and the average debt to Gross Domestic Product (GDP) ratio of the East Caribbean Central Union (ECCU) is around 82.03 per cent of Gross Domestic Product (GDP) of which St Kitts and Nevis was 147.76 per cent, Grenada 93.48 per cent and Antigua and Barbuda 85.23 per cent. These three territories sought International Monetary Fund (IMF) programmes because of their fiscal and debt challenges. By 2015, the East Caribbean Central Union (ECCU) average of debt to Gross Domestic Product (GDP) had decreased to approximately 76 per cent, while the reduction in debt was largely due to debt restructuring, of the three countries under International Monetary Fund (IMF) programmes. Only Antigua and Barbuda's debt did not materially change even though there were efforts at debt restructuring.

The genesis of debt accumulation can largely be attributed to the need to rebuild infrastructure which came about as result of natural disasters. There are weather events in the Windward Islands, St Vincent and the Grenadines, Saint Lucia, Grenada and Dominica. While in Antigua and Barbuda, debt accumulation was as a

result of financial sector restructuring. For example, in Dominica the most recent weather event was a tropical storm (Erika) which in August 2015 caused damage to the infrastructure of approximately 96 per cent of Gross Domestic Product (GDP), and recently as a few weeks ago, there were road collapses and other water damage as a result of heavy rains.

Another challenge facing the East Caribbean Central Union (ECCU) is the financial sector crisis. The fall out of two famous insurance conglomerates, Colonial Life Insurance Company (CLICO) and British American Insurance Company (BAICO) had affected many people and many will not be recovering full amount lost. This has been an issue of concern for East Caribbean Central Union (ECCU) as the cost of collapse was estimated to be around 19 per cent of the 2009, Gross Domestic Product (GDP) of the region. To curb the menace, various steps has soon been taken by the region, one was enacting uniform insurance legislation for enactment in all territories of East Caribbean Central Union (ECCU). The legislation is expected to give more power to a supervisor to anticipate the activities of the insurance operators vulnerable of affecting the clients. An eight point's stabilization and growth agenda has been concisely pursue to regain the speed of the region's growth.

The world's biggest monetary union is the European Union (EU) zone, the European Union is a political and economic union of Twenty eight[8] states primarily located in Europe. It has its origin from the European Coal and Steel Community established in 1951 and European Economic Community established in 1957, with only Six[9] members. From 1948 to 2009, there were around eleven important treaties[10] [34] in the European Union area. The Treaty of Maastricht of 1992-1993 gave birth to the single currency which was later launched in 2000.

One gigantic difference between the East Caribbean Central Union (ECCU) and West African Monetary Zone (WAMZ), and their European Union counterpart is that the European Union has almost 24 official languages while the West African Monetary Zone (WAMZ) area maintained only French and English also the East Caribbean Central Union (ECCU). There are about Twenty eight[11] members in the European Union, out of which about nineteen of its members are using the Euro as their official currency. The idea of coming up with the currency was born following the Maastricht Treaty in 1995, and to participate in the currency, members were given criteria to meet. The criteria included budget deficit of less than 4 per cent of the Gross Domestic Product (GDP) of the concern country, a debt ratio of less than 60 per cent of the Gross Domestic Product (GDP), as well as single digit inflation and low interest rate, considered one of the most successful currencies in the world with the highest trading frequency after the US dollars.

An issue that raised concern in the Euro zone recently, is the Greece debt crisis. In early 2009 Greece had borrowed heavily from the international capital market in order to finance their budgets and trade deficits. This situation leads to the public and investor's loss of confidence. The skyrocketing of the interest rate worsened the situation and made the borrowing cost unbearable. The Greece problem implicated other countries that are averagely developed in the region like Portugal, Ireland, and Spain. Thus, the crisis affected the banking industry of the European Union. In order to arrest the problem, the European Union as well the Internal Monetary Fund (IMF) came up with various bail-out packages. A more recent crisis in the region is the exit of Britain in 2016 from the European Union which was seen as a great threat to the region and the union as a whole. The consequences of Brexit are numerous for both parties. Economists in the United Kingdom and around believe that United Kingdom's remaining in the European Union will help them to maintain and grow their real per capita income over a time and vice versa. This development has projected that the United Kingdom will be poorer in the long run in the sense of losing Foreign Direct Investment (FDI); it will create trade barriers between the United Kingdom and European Union zone, as well as restrict free movement of labour between the two regions. However, despite the aforementioned issues, the European Union region will lose a huge

[8] Australia, Italy, Belgium, Latvia, Bulgaria, Lithuania, Croatia, Luxemburg, Cyprus, Malta, Czech Republic, Netherland, Denmark, Poland, Estonia, Portugal, Finland, Romania, France, Slovakia, Germany, Slovenia, Greece, Spain, Hungary, Sweden, Ireland, and the U.K(withdrawn).

[9] Belgium, France, Italy, Luxembourg, the Netherlands and West Germany.

[10] 1948-Brussels Treaty (1951-52), Paris Treaty (1954-55) modified Brussels Treaty (1957-58), Rome Treaty (1965-67), Merger Treaty (1975-76), Council Agreement on Trevi (1986-87), Single European Act (1990-95), Schengen Treaty (1992-93) Maastricht Treaty, (1997-99), Amsterdam Treaty (2001-003), Nice Treaty (2007-2009), Lisbon Treaty.

[11] The EU countries are: Austria, Belgium, Bulgaria, Croatia, Republic of Cyprus, Czech Republic, Denmark, Estonia, Finland, France, Germany, Greece, Hungary, Ireland, Italy, Latvia, Lithuania, Luxembourg, Malta, Netherlands, Poland, Portugal, Romania, Slovakia, Slovenia, Spain, Sweden and the UK

contribution in terms of their Gross Domestic Product (GDP), since the United Kingdom is one of the strongest economies in the area, thereby reducing the per capita income level of the area. As a strong industrial nation, the United Kingdom has a huge export volume which can contribute to the European Union's trade surplus and, in turn, strengthen the Euro currency.

The issue of business cycle has so many dimensions. A lot of researches have contributed in almost all aspects of business cycle specially, after the great depression of the 1920's. One issue that engulfed the literature was trying to find out the sources of business cycle. Some of the studies have focused and discussed extensively in this regard. For example Arthur F. Burns [25] investigate the causes of business cycle, where he found different view that exist in the literature, some having the view that monetary variables are responsible for business cycle, and some attributing the phenomena to the technology, while some researchers are of the view that it is indeed the nature of the fixed working capital that lead to business cycle.

In the same way, in the business cycle literature, great moderation is one aspect which is well researched by the scholars. It is believed that, the world has experienced a reduction of volatility in the macroeconomic variables, meaning that there is reduction of business cycle threat especially in the 1990's and 2000's. This reduction in volatility is attributed to the impact of globalization, financial integration and so on and a similar study in this regard was conducted by James H. Stock and Mark W. Watson [26]. One important issue that took the attention of the scholars in the area of business cycle is of course that of the dating of the business cycle and turning points, for example, the work of Francis X. Diebold, Glenn D. Rudebusch [27], Pami Dua, Anirvan Banerji [28], Travis J. Berge and Òscar Jordà [29], Pandey (etl.,) [30] the dating of the business cycle provides the exact chronology of the cycle in the economy, it is of paramount importance because history in most cases repeats itself if the same status quo is maintained and now, to learn from the past the dating becomes significant, similarly, the turning points.

Moreover, prediction of business cycle has taken the interest of the researchers; some studies conducted on this aspect there are three important indexes that are being used frequently by researchers to predict the occurrence of business cycle. These indexes include, leading, lagging and coincident indicators.
Thus, leading indicators are those that first crash before Gross Domestic Product (GDP), while covering indicators crash after Gross Domestic Product (GDP), and finally, the coincident indicators or index, that crash at the same time with the Gross Domestic Product (GDP). In any of the cases, these indicators are very significant in assess the set in of business cycle in the economy. Thus, with the help of these indicators, business cycle could be forecasted well and could be prevented. International business cycle synchronization or international co-movement has been another important aspect of business cycle where a lot of ink has been spilled for example, the work of Zsolt Darvas, Andrew K. Rose, György Szapáry [31], Marco Del Negro and Christopher Otrok [32]. In this aspect, researchers seek to find out the reasons for synchronization of business cycle of different economies. Hyeon-seung Huh, David Kim, Won Joong Kim, and Cyn-Young Park [33] had conduct their study on international co-movement related to some selected Asian economies and found the existence of synchronization in the studied area. There are different reasons the studies found, as to why co-movement exists within countries. While, some found similarity in terms of monetary policy shock and some due to similar response in technological shock, etc.

III. RESEARCH METHODS

In this section, the methodology used in the study will be discussed in detail. The section comprises of sources of data, and explanation with specification of the model used for analysis.

Sources of Data and Variables: Our series were sourced from the World Bank and Federal Reserve Bank of St. Louis. Most of the studies of international co-movement or business cycle synchronization used either monthly or quarterly data, for example Sims, Christopher [34], Del Negro and Otrok [35], Hyeon-seung Huh, David Kim, Won Joong Kim, and Cyn-Young Park [36], King, Stock and Watson [37], Ben Bernanke, Jean Boivin, Piotr Eliasz [38]and many more. However, it is a different situation in our case for some reasons, one is that, most West African countries do not have a good record of data and therefore have very few data available. Secondly, for some series whose data are available, especially those we have used for our study, only annual frequencies are available. Thirdly, some countries like Nigeria have monthly and quarterly data but the same is not the case for all the countries. So, in order to have a uniform frequency of the series for all the series across all the countries, annual data was used which is available for almost all the countries except Guinea Conakry. Therefore, Guinea Conakry is excluded from the study due to missing values in most of the series and lack of complete observations in some of the series.

This study follows the work of Bagliano and Morana [39] and Hyeon-seung Huh, David Kim, Won Joong Kim, and Cyn-Young Park [40]. The study is similar to the above studies in terms of methodology and variables used. These studies used quarterly series for US, Japan, EU and East Asian countries respectively, but due to the above reasons we are unable to get quarterly data. The samples of this study are the 14 West African

countries out of 15 Economic Community of West African Countries (ECOWAS)[12]. Six variables are collected from each of the 14 countries from 1980-2016. The variables of our study include GDP at constant prices, which represent economic activity series, prices (inflations), M2 which is a monetary series and represents money supply, exchange rate, export and import. Similarly, two external variables are considered, that is, world GDP, and crude oil prices.

The series are all converted to the same unit of measurement by deducting a mean of the series from each observation and dividing each observation with the series' standard deviation. Franses and Boswijk [41]. describes the monthly and quarterly data to be suspected of having a seasonal effect, as such seasonality need to be checked in the series. If this holds, it means our series are exempted for seasonality threat and we therefore did not check for the seasonality in that regard. Similarly, the orders of integration[13] of the series were checked, and majority of the series are level non-stationary. Factors extracted from the series can be either with structure as in Hyeon-seung Huh, David Kim, Won Joong Kim and Cyn-Young Park [42] or without structure as in Stock and Watson [43]. The method followed here is that of the Stock and Watson procedure, where factors were extracted from the group of variables all together. Similarly, there are three methods in which the factors can be extracted; one is the principle component analysis (PCA), the Bayesian method, and spectral analysis. We have used PCA to generate our factors, invented by Pearson, Karl [44] and suggested by Cook and Manning [45].

After extracting the factors and realizing that the factors were completely scattered and there were insignificant loadings to represent our series, we then decided to divide our 6 series into two groups, and factors were extracted from them. The first group comprises of GDP, inflation, and money supply (M2) and the second group comprising of export, import and exchange rate. From the first group a factor with good loading of the Eigen Value represents the economic activity and it was named GDP shock, the second factor is named as the monetary policy shock. In the second group, two factors were generated one is external factor which represents common import and export in the region, and the exchange rate factor, which represents the common exchange rates in the region. However, only the impact of these shocks on GDP has been reported.

Econometric Framework: Factor Augmented Vector Autoregressive Model (FAVAR) is a model which gained popularity and momentum for its inclination to solve most of the problems associated with VAR. Thus, applying FAVAR will aid you to get full information captured in the model, no issues related to over-parameterization, or a dimensionality problem, have more forecasting power as surveyed by Ben, Bernanke and Jean Boivin [46]. It has also solved all the problems of the estimation gap between theoretical and empirical concepts. The use of factors in the time series modeling was first introduced by Sergent [47]. and Geweke [48] however, Stock and Watson [49] have popularized this modeling procedure when they used factor model based on over hundred series to model inflation dynamics. Similarly, [38] Ben S. Bernanke, Jean Boivin, Piotr Eliasz [50] were first to extend the factor modeling to vector auto regression, and thus build a Factor Augmented Vector Auto regression Model (FAVAR).

In this modeling approach introduced by Bernanke, Boivin and Eliasz observables and non-observables series were introduced. The observables are those series which we can directly be measured; similarly, non-observables are those series which cannot directly be measured, for example, output gap. Since output gap cannot be observed, factors extracted can be used to represent the series. In either case, both observables and non-observables are allowed to follow a VAR process.

After the application of Factor Augmentation to VAR framework by Bernanke, Boivin, and Eliasz many researchers followed suit and applied the methodology in various research works, for example; James H. Stock, and Mark W. Watson [51] James H. Stock, and Mark W. Watson [52], Sandra Eickmeier and Jörg Breitung [53], Sandra Eickmeier [54], James H. Stock and Mark W.Watson [55], Del Negro, and Otrok [56], Pooyan Amir Ahmadi [57], Bagliano and Morana [58], Stock and Watson [59], Pellényi, Gábor [60] and Hyeon-seung Huh, David Kim, Won Joong Kim, and Cyn-Young Park [61] etc.

To understand the application of a FAVAR methodology, firstly we demonstrate the factors extraction process. Thus, consider the equation below in which X_t is vector with large macroeconomic variables. Now, to disentangle X_t from observed and unobserved elements reported by Y and F respectively, we have the following relation.

$$X_t = \Gamma_1 F_t + \Gamma_j Y_t + e_t \quad (1)$$

[12] The 15 ECOWAS members include Nigeria, Niger, Mali, Burkina Faso, Senegal, Guinea Bissau, Guinea Conakry, Liberia, Sierra Leon, Ivory Coast, Ghana, Togo, Benin, Gambia and Cape Verde.

[13] See appendix for the table on how the orders were determined.

Where X_t is an $N\times 1$ vector of macroeconomic variables, Γ_1 and Γ_j are $N\times M$ Vectors of factor loadings and structural coefficients respectively. e_t Is the random disturbance term with zero mean and constant volatility. Equation 1 could be Augmented in VAR framework and could be re-written as below;

$$\begin{bmatrix} F_t \\ Y_t \end{bmatrix} = Q_1 + Q_2(L)\begin{bmatrix} F_t \\ Y_t \end{bmatrix} + v_t \qquad (2)$$

Where Q1 is the vector of intercepts, Q2 is the $N\times M$ Matrix of factor loadings and V_t is the Kx1 vector of reduced form errors, which are also assumed to have zero mean and constant variance.

In order take care of the criticism that the estimates from equation 2 lack economic meaning, the FAVAR of equation 2, could be extended to include structural identification of the factors, thus the model becomes FA-SVAR, and could be specified as below;

$$Ay_t = \theta_1 + \theta_2(L)Y_t + \mathrm{B}et \qquad (3)$$

Here, A is an $N\times N$ contemporaneous impact matrix which measures the simultaneous response of the variables. B is an $N\times N$ matrix, and it represents the instantaneous impact of the structural shocks. Y_t is $N\times 1$ vector of endogenous variables.

The term, $\theta_2(L)Y_t$ represent the dynamics component of the explanatory variables and et is an $N\times 1$ vector of structural shocks. When we divide both sides by A, we obtain a reduced form equation. Thus;

$$A^{-1}\mathrm{B}et \qquad (4)$$

Where A is an $M\times N$ Matrix of contemporaneous response, B is the $M\times K$ variance co-variance matrix, et is the vector of structural shocks.

There are different ways in which restriction can be imposed to identify equation 4 based on A model, B model, and or AB model. Thus, the restrictions could be recursive as suggested by Sims [62], Wold restriction as suggested by Herman O. Wold [63] restriction based on heteroscedasticity and signs as in Kilian (2012) and restriction based on economic theory. For the purpose of our study, a recursive restriction is used as suggested by Sims (1980). Thus, the model needs $K\left(\frac{K-1}{n}\right)$ restrictions to identify the model as exactly identified. The restrictions on the model are as follows:

$$\mathrm{A}=\begin{bmatrix} 1 & 0 & 0 & 0 \\ 0 & 1 & 0 & 0 \\ 0 & 0 & 1 & 0 \\ 0 & 0 & 0 & 1 \end{bmatrix}\begin{bmatrix} U_i \\ U_{ii} \\ U_{iii} \\ U_{iv} \end{bmatrix} \qquad \mathrm{B}=\begin{bmatrix} b_{11} & 0 & 0 & 0 \\ b_{21} & b_{22} & 0 & 0 \\ b_{31} & b_{32} & b_{33} & 0 \\ b_{n1} & b_{n_2} & b_{n3} & b_{nm} \end{bmatrix}\begin{bmatrix} e_i \\ e_{ii} \\ e_{iii} \\ e_{iv} \end{bmatrix} \qquad (5)$$

Where A, is a diagonal matrix, and measures the contemporaneous response of the macroeconomic variables in the system. B matrix is a lower triangular matrix, and measures the impact of contemporaneous shock.

IV. EMPIRICAL RESULTS AND DISCUSSION

Impulse Response Functions: In the previous section we analyzed the impact of regional and global shocks on the West Africa macroeconomic variables. It could be recalled that our regional shocks consist of regional output, regional exchange rate, regional nominal variable, and the rest of the world shocks; whereas the two global shocks are crude oil price and world GDP shocks. In this section, issues related to transmission mechanism are analyzed through the impulse response mechanism. Due to space limitations on one hand, the 2nd, 4th, and 6th horizons were observed for the analysis of the transmission mechanism of the GDP series of the West African countries. On the other hand, the choice of the horizons is mainly due to the consensus of the literature that cycles lasts for a minimum of two years. Table 1.1 present the impulse response function for each country.

Table 1.1 Impulse response functions of GDP at 2nd, 4th and 6th horizons

Variables	GDPFactor	EXGFactor	NMVF	RWF	OILP	WGDP
GDPNGN 2nd	0.011(0.020)	0.021(0.013)	0.007(0.023)	0.019(0.019)	0.025(0.021)	-0.014(0.018)
4th horizon	0.010(0.023)	0.010(0.015)	0.001(0.021)	0.015(0.022)	0.012(0.026)	0.010(0.016)
6th horizon	0.031(0.027)	0.011(0.016)	0.011(0.021)	-0.021(0.027)	0.030(0.028)	0.002(0.014)
GDPNR 2nd	-0.016(0.035)	-0.031(0.035)	0.040(0.047)	-0.02(0.037)	-0.018(0.040)	-0.019(0.035)

4th horizon	0.001(0.036)	-0.034(0.037)	0.005(0.04)	-0.063(0.039)	-0.024(0.040)	-0.006(0.033)
6th horizon	-0.001(0.040)	-0.026(0.047)	-0.003(0.04)	-0.070(0.040)	-0.006(0.047)	0.008(0.027)
GDPGH 2nd	-0.007(0.023)	-0.008(0.031)	0.069(0.042)	-0.094(0.034)	0.009(0.024)	0.038(0.020)
4th horizon	-0.025(0.025)	0.020(0.045)	0.021(0.059)	-0.042(0.058)	0.032(0.026)	0.001(0.024)
6th horizon	-0.062(0.037)	0.061(0.065)	0.004(0.070)	0.027(0.079)	0.073(0.035)	0.029(0.031)
GDPPLIB 2nd	-0.123(0.11)	0.016(0.085)	0.192(0.129)	-0.077(0.138)	0.039(0.130)	0.009(0.11)
4th horizon	-0.070(0.112)	-0.041(0.075)	-0.042(0.123)	-0.043(0.112)	0.031(0.128)	0.014(0.095)
6th horizon	-0.085(0.10)	0.141(0.075)	-0.045(0.123)	-0.012(0.088)	0.066(0.139)	0.005(0.086)
GDPSRL 2nd	0.036(0.045)	-0.014(0.067)	-0.022(0.070)	-0.029(0.057)	-0.030(0.049)	-0.099(0.053)
4th horizon	0.008(0.055)	0.055(0.077)	0.029(0.076)	0.054(0.057)	-0.089(0.059)	-0.083(0.062)
6th horizon	-0.019(0.055)	-0.004(0.078)	-0.033(0.082)	-0.024(0.067)	0.186(0.084)	0.118(0.082)
GDPCTD 2nd	-0.039(0.061)	0.008(0.048)	0.106(0.067)	-0.102(0.046)	0.052(0.046)	0.008(0.045)
4th horizon	-0.015(0.054)	0.001(0.043)	-0.026(0.079)	-0.125(0.058)	-0.041(0.067)	-0.059(0.047)
6th horizon	0.001(0.054)	0.013(0.045)	-0.077(0.089)	-0.020(0.078)	-0.019(0.101)	0.017(0.039)
GDPBNN 2nd	-0.019(0.021)	-0.036(0.039)	0.029(0.040)	0.051(0.038)	0.021(0.038)	0.064(0.040)
4th horizon	0.047(0.027)	0.004(0.039)	-0.0007(0.05)	0.009(0.035)	0.077(0.038)	0.036(0.050)
6th horizon	0.040(0.034)	0.025(0.040)	-0.007(0.05)	0.004(0.036)	0.015(0.048)	0.020(0.050)
GDPGMB	-0.006(0.033)	0.055(0.030)	0.016(0.036)	-0.012(0.016)	-0.007(0.021)	-0.031(0.022)
2nd	-0.012(0.033)	0.003(0.028)	0.037(0.037)	-0.001(0.015)	0.001(0.025)	-0.020(0.024)
4th horizon	-0.0008(0.03)	-0.005(0.028)	-0.023(0.036)	0.010(0.013)	0.019(0.026)	0.040(0.024)
6th horizon						
GDPTGO 2nd	0.157(0.127)	-0.368(0.153)	0.116(0.147)	0.115(0.087)	0.092(0.160)	-0.022(0.159)
4th horizon	-0.100(0.128)	-0.147(0.161)	0.114(0.158)	-0.077(0.061)	-0.001(0.158)	0.019(0.137)
6th horizon	-0.079(0.154)	0.099(0.171)	-0.157(0.188)	0.032(0.046)	-0.013(0.196)	0.095(0.135)
GDPSNG 2nd	0.022(0.014)	-0.023(0.015)	0.010(0.018)	-0.002(0.014)	-0.005(0.020)	-0.006(0.018)
4th horizon	0.014(0.018)	-0.025(0.016)	0.014(0.018)	-0.003(0.013)	0.003(0.020)	-0.015(0.020)
6th horizon	0.031(0.020)	-0.019(0.017)	-0.011(0.019)	0.002(0.010)	0.008(0.021)	0.003(0.014)
GDPMAL 2nd	-0.040(0.085)	-0.025(0.037)	-0.010(0.053)	-0.020(0.021)	0.048(0.036)	0.093(0.031)
4th horizon	-0.035(0.085)	0.012(0.037)	0.065(0.044)	0.029(0.016)	0.125(0.039)	0.091(0.045)
6th horizon	0.153(0.090)	-0.005(0.037)	0.009(0.048)	-0.020(0.015)	0.0003(0.048)	-0.023(0.052)
GDPBRK 2nd	0.001(0.013)	-0.005(0.013)	-0.006(0.013)	0.010(0.015)	0.002(0.014)	0.0003(0.012)
4th horizon	-0.002(0.014)	-0.012(0.013)	0.013(0.013)	-0.016(0.016)	0.004(0.015)	0.001(0.013)
6th horizon	0.019(0.017)	-0.005(0.013)	0.001(0.013)	-0.015(0.017)	0.028(0.023)	0.014(0.009)
GDPCPD 2nd	-0.050(0.032)	0.007(0.045)	0.035(0.056)	-0.027(0.049)	0.058(0.044)	0.109(0.048)
4th horizon	0.007(0.033)	-0.010(0.036)	0.017(0.051)	0.011(0.043)	0.075(0.042)	0.098(0.060)
6th horizon	0.047(0.041)	0.023(0.038)	-0.018(0.056)	-0.010(0.054)	-0.002(0.061)	-0.066(0.077)
GDPGBS 2nd	0.069(0.062)	-0.101(0.047)	0.031(0.078)	0.140(0.072)	-0.024(0.070)	0.025(0.068)
4th horizon	0.020(0.065)	-0.058(0.055)	0.046(0.084)	0.002(0.065)	0.110(0.075)	0.023(0.071)
6th horizon	0.020(0.068)	0.041(0.059)	0.010(0.071)	-0.015(0.067)	0.008(0.082)	-0.023(0.059)

Source: Computed

Table 1.1presents the impulse response function of GDP series of West African countries at three different horizons as a result of the regional and the global shocks. Due to a regional output shock, all countries reacted in a negative manner at the 2nd horizon except Nigeria, Sierra Leone, Burkina Faso and Guinea Bissau, which implies that there is a co-movement among the majority of the West African countries in terms of response as a result of regional output shock except the aforementioned 4 countries. Likewise, in the 4th horizon, two blocks are identified. The first block comprises Nigeria (0.010), Niger (0.001), Sierra Leone (0.008), Benin (0.047), Senegal (0.014), Cape Verde (0.007) and Guinea Bissau (0.020) where all the countries had a positive response. Similarly, the remaining countries had a negative response and these countries comprise Ghana (-0.025), Liberia (-0.070), Gambia (-0.012), Mali (-0.035), and Burkina Faso.

The 6thhorizon also came in two blocks, those countries that reacted positively include Nigeria, Benin, Senegal, Mali, Burkina Faso, Cape Verde, and Guinea Bissau, while the remaining countries have reacted negatively to the regional GDP. Looking at the regional exchange rate shock in the 2nd horizon, all the countries reacted negatively except Nigeria, Ivory Coast, Gambia, and Cape Verde, which implies that all the WAEMU countries have the same response to the shock except Ivory Coast. Similarly, in the 4th and 6th horizons, Nigeria remains in its previous position, while Ghana joins them and reacted in both horizons positively. Other countries that have a positive response in both horizons include Ivory Coast and Benin. The response remained mixed for the monetary policy variable, oil price and world GDP shock.

Forecast Error Variance Decomposition (FEVD): In this section, we analyze the relative contribution of each country's output to fluctuation in the system. Certain countries have more influence than the others in bringing about a fluctuation in the system; forecast variance decomposition will help us to determine those countries with little or high contribution to these disturbances. Thus, we will be able to assess the degree of synchronization of the West African countries by observing the extent of each variable's

contribution to fluctuation. **Table 1.2** presents the forecast error variance decomposition of the West African countries' GDPs. The forecast error variance is very low in the 2nd horizon as contributed by each country. The country that contributed the highest percentage of the fluctuation in this series is Gambia which contributed 7.1 per cent of the total fluctuation. Other countries that have contributed to the fluctuation of the series include Nigeria with 4.9 per cent contribution, Sierra Leone which contributed 2.7 per cent, and Ivory Coast with 3 per cent contribution. Moreover, Togo contributed 3.1 percent, Senegal 4.3 percent, Mali 3.9 per cent, Burkina Faso 2 percent, Cape Verde 4 percent, and Guinea Bissau 2.9 per cent.

This close contribution by each country is a testimony to the synchronous nature of the countries. In the 4th horizon the error variance contributed by Ivory Coast, Gambia, Cape Verde and Guinea Bissau is 13 percent, 15.3 per cent, 12.1 per cent, and 14.1 per cent, respectively. While the remaining countries contributed less than 10 per cent each. This implies a co-movement among all the countries except Ivory Coast, Gambia, Cape Verde, and Guinea Bissau. In the 6th horizon countries like Ivory Coast, Gambia, Mali and Cape Verde have contributed very highly which made them different from other countries.

Table 1.2 Variance Decomposition of GDP at 2nd, 4th horizons and 6th horizon

Variables	GDPFactor	EXGFactor	NMVF	RWF	OILP	WGDP
GDPNGN	4.988	1.100	0.194	1.777	11.17	0.754
4thhorizon	5.263	2.362	8.069	9.225	6.752	38.10
6thhorizon	5.202	2.637	11.82	12.89	9.056	53.79
GDPPNR	0.946	0.427	0.142	0.10	3.51	5.66
4thhorizon	10.40	2.351	2.373	0.71	7.40	7.73
6thhorizon	8.658	2.828	6.749	1.44	6.78	6.90
GDPGH	1.30	18.08	3.90	1.60	25.49	4.39
4thhorizon	4.07	21.45	5.47	4.13	33.83	2.52
6thhorizon	23.45	35.98	7.31	13.3	35.41	12.4
GDPPLIB	0.32	0.030	0.007	3.23	0.60	0.006
4thhorizon	2.08	3.76	1.94	4.80	1.52	0.220
6thhorizon	3.95	12.11	2.83	9.32	1.39	0.104
GDPSRL	2.708	15.16	0.291	7.060	2.074	0.219
4thhorizon	2.304	37.40	16.00	15.00	2.410	0.890
6thhorizon	3.248	35.90	27.34	15.61	2.397	0.528
GDPCTD	3.059	5.677	7.66	1.039	10.99	6.145
4thhorizon	13.086	34.43	21.46	9.987	10.74	37.52
6thhorizon	31.96	44.89	40.43	35.34	13.91	52.49
GDPBNN	1.048	4.502	0.015	3.029	5.948	0.054
4thhorizon	0.974	19.300	12.36	9.781	8.540	9.015
6thhorizon	16.60	21.59	14.72	12.22	15.46	11.51
GDPGMB	7.174	5.276	0.095	0.073	0.226	0.971
4thhorizon	15.35	9.763	2.900	7.539	2.811	22.28
6thhorizon	18.07	15.26	15.07	11.20	34.76	45.04
GDPTGO	3.112	0.218	3.700	0.528	4.389	3.035
4thhorizon	2.832	8.096	5.007	0.476	5.020	3.913
6thhorizon	5.237	6.369	10.60	0.513	8.344	10.89
GDPSNG	4.363	1.517	1.545	0.052	5.795	0.298
4thhorizon	5.822	4.982	2.943	8.025	7.820	0.793
6thhorizon	4.914	7.050	7.111	9.650	8.274	1.707
GDPMAL	3.943	14.72	4.933	11.06	2.427	0.001
4thhorizon	7.651	28.87	6.931	10.70	6.676	15.52
6thhorizon	22.47	26.80	7.201	11.87	6.436	23.52
GDPBRK	2.021	0.475	2.738	0.254	2.212	18.75
4thhorizon	8.536	2.663	3.038	4.027	4.311	41.82
6thhorizon	7.577	11.72	5.878	5.705	3.719	42.23
GDPCPD	4.019	1.385	0.231	2.896	28.50	10.15
4thhorizon	12.13	19.61	8.783	9.309	43.01	21.22
6thhorizon	42.52	26.13	16.06	18.46	43.25	47.21
GDPGBS	2.906	0.012	11.33	13.85	3.468	2.468
4thhorizon	14.41	1.079	22.48	13.06	2.928	3.233
6thhorizon	12.92	7.349	30.15	15.61	3.476	4.899

Source: Computed

The contribution of forecast error variance of each country as a result of a regional exchange rate shock is synchronous, except Ghana (18%), Sierra Leone (15%), and Mali (14.7%). Similarly, the 4th and 6th horizons have different percentages of the forecast error variance. The 2nd horizon of the forecast error variance for the countries has shown a close movement among the countries. The 4th horizon is also synchronous except for

Niger Republic. Coming to the forecast error variance of crude oil shock, it shows that there is close contribution to the disturbance among the countries except Nigeria, Ivory Coast and Cape Verde. Similarly, the 4th and 6th horizons show a very close movement in terms of the contribution of the variances except for Ghana and Cape Verde. The forecast error variance of the 2nd horizon of world GDP shock is recorded as follows: Nigeria (0.7), Niger (5.66), Ghana (4.39), Liberia (0.006), Sierra Leone (0.21), Ivory Coast (6.1), Benin (0.054),Gambia (0.97), Togo (3.03), Senegal (0.298), Mali (0.00), and Guinea Bissau (2.46), which shows a minimal contribution to the fluctuation in the series by each country; however, those countries that have high variance in the same horizon are Burkina Faso (18.7) and Cape Verde (10.1).

V. CONCLUSION

We have conducted analysis using a Factor Augmented Vector Autoregressive (FAVAR) framework to investigate the level of co-movement among the West African countries. We have used a total of 86 variables from 14 countries; that is, 6 macroeconomic variables were taken from each country in addition to two global variables which are world GDP and crude oil prices. The study assesses a co-movement among the 14 West African countries by observing the synchronization behavior of each country. The study concludes in favor of the single currency due to the following points:

1. The regional output factor has a similar trend with the individual output of majority of the countries.
2. Majority of the countries responded to a regional output shock positively in the 2nd and 4th horizons, while seven countries have a positive response and the remaining seven country's response is negative.
3. Due to regional exchange rate shock, all the countries had similar response except four in the 2nd horizon
4. The contribution to fluctuation as a result of regional output shock is similar in the second horizon. About 13 countries have contributed between 0 to 5 percents to fluctuations in the 2nd horizon, while in the 4th horizon, only four countries have low contribution to fluctuation while majority of the countries have high contribution. This is similarly in the 6th horizon.
5. Due to exchange rate shock, nine countries have very low contribution to fluctuation in 2nd horizon which is between 0 to 4 percents. Six countries have a very low contribution in the 4th horizon and the remaining countries contributed with high percentages of fluctuations.
6. There is also a co-movement in the 2nd horizon of the monetary policy shock. About 14 countries have a similar and a low contribution of the forecast error variance.
7. Oil price and World GDP shocks show majority of the countries having similar contribution and thus synchronous.
8. Observing the above points and the entire analysis, we can confirm that, as it is not possible to have 100 percent similar responses, but majority of the countries have similar response and business cycle.
9. Finally, some researchers like Uzonwanne(2012), believe that, the study of macroeconomic variables alone could not determine the success of a single currency but political will. Therefore, with a strong political will among the participating countries, even with a presence of little divergence in macroeconomic realities among the countries, single currency can be successful.

Recommendations: This study therefore recommends the following: The West African Countries need to improve efforts in internally generated revenue (Tax) as one the convergence criterion. Most of the countries are very poor in implementing the tax policies for example Nigeria is generating as low as 0.5 percent tax as a percentage of the country's GDP. These countries have a number of indigenous and foreign companies increasing effort to diversify the revenue generation will help to avoid central banks printing money to pay salaries or to cover part of the budget deficit, thus, avoidance of instability in the money supply in the response.

To mprove on the performance of the economy especially towards achieving the macroeconomic convergence and to facilitate macroeconomic synchronization, there is need to maintain peace and stability in the region especially in countries like Nigeria, Niger, Benin, Togo, which are bedeviled by the Boko Haram crisis. Burkina Faso is one country which has prevalence of terrorist activities around its boarders, therefore, the regional security force need to address such issues so that the attention of the country's leaders could not be deviated from attaining the economic goals of the country and the economic goals of the entirely region.

Similarly, the region needs to tackle the problem of leaders wanting to stay on power forever like what happen recently in Ivory Coast when Lauren Bagbo refused to concede defeat to Allassan Ouatara, similar case was also reported in Nigeria in 2007, when President Obasanjo wanted to remain on power for the third term, these kinds of tensions will definitely lead economy to deviate from its long run path, and are therefore need to be addressed.

Crisis related to civil and ethnic wars are very common in the region, leaders of the region need to sit down and come up with modalities to avoid prevalence of such issues in the region. The communal killings like what is happening in Nigeria between farmers and herdsmen, this is also happening in the neighboring Niger

republic, and many similar issues need to be addressed in order to avoid unintended security expenditure which will consume a lot of resources that could have been used in other developmental projects.

REFERENCES

[1] Robert A. Mundell (1961), A Theory of Optimum Currency Areas, *The American Economic Review, Vol. 51(4).*

[2] Mckinnon R. (1963), Optimum Currency Areas, *The American Economic Review, Vol. 53(4).*

[3] Simplice G. Zouhon-Bi and Lynge Nielsen (2007), ECOWAS – Fiscal Revenue Implications of the Prospective Economic Partnership Agreement with the EU, *Africa Region Working Paper Series Number 103.*

[4] João Loureiro, Manuel M.F. Martins, Ana Paula Ribeiro (2012), Anchoring to the Euro (and Grouped Together)? The Case of African Countries, *Journal of African Economies*, Vol. 21(1).

[5] Carlos Vieira, Isabel Vieira (2013), Monetary Integration in Eastern and Southern Africa: Choosing A Currency Peg For Comesa, *South African Journal of Economics*, Vol. 25(2).

[6] Paulo Drummond, etl (2012), *Toward a Monetary Union in the East African Community: Asymmetric Shocks, Exchange Rates and Risk-Sharing Mechanisms*, International Monetary Fund, IMF Publication Services P.O. Box 92780, Washington, DC 20090, U.S.A.

[7] Chuku, Chuku (2012), *The proposed eco: should West Africa proceed with a common currency?, A*nnual conference of the Centre for Studies of African Economies (CSAE), Oxford University, 18th -20th March 2012, Munich Personal RePEc Archive (MPRA) Paper, MPRA Paper No. 43739.

[8] Hyeon-seung Huh, David Kim, Won Joong Kim, and Cyn-Young Park (2014), *A Factor-Augmented Vector Auto regression Analysis of Business Cycle Synchronization in East Asia and Implications for a Regional Currency Union*, Asian Development Bank (ADB), The Asian Development Bank Economics Working Paper Series No. 385, Philippines

[9] Christopher A. Sims (1980), Comparison of Interwar and Postwar Business Cycles: Monetarism Reconsidered, *The American Economic Review*, Vol. 70(2).

[10] Matthew D. Shapiro, and Mark W. Watson (1988), *Sources of Business Cycles Fluctuations*, Naqtional Bureau of Economic Research (NBER) Macroeconomics Annual, The University of Chicago Press Journals, Chicago, Vol.3 (2).

[11] James H. Stock and March M. Watson (2011), *Dynamic Factor Models*, In Oxford Handbook on *Economic Forecasting (*eds), Michael P. Clements and David F. Hendry. Oxford: Oxford University Press.

[12] Marco Del Negro and Christopher Otrok (2008), *Dynamic Factor Models with Time-Varying Parameters: Measuring Changes in International Business Cycles*, Federal Reserve Bank of New York Staff Reports, Staff Report no. 326, New York

[13] Ibid., Chuku, Chuku (2012)

[14] Ekong, Christopher N. and Onye, Kenneth U. (2012), *On The Feasibility of a Common Currency in West Africa: Evidence from a Multivariate Structural VAR, Current Research Journal of Economic Theory*, Vol. 4(4).

[15] Bayoumi, Tamim, and Barry Eichengreen, (1993), *Shocking Aspects of European Monetary Integration*, in Francisco Torres and Francesco Giavazzi, (eds)., *Adjustment and Growth in the European Monetary Union*, Cambridge, Cambridge University Press.

[16] Roman Horvath And Lubos Komarek (2002), *Optimum Currency Area Theory: An Approach ffor thinking about integration*, Wariwick Economic Research Papers, Research Paper No.647 , Department of Economics, The University Wariwick, Czech Republic, Czech.

[17] Ibid., Simplice G. Zouhon-Bi and Lynge Nielsen (2007)

[18] Olanrewaju R.R.(2013), Impact of Misaligned Real Exchange Rate on Economic Performance: A case study of West African Monetary Zone, *IOSR Journal of Economics and Finance,*Vol.1(6).

[19] Ibid., Carlos Vieira, Isabel Vieira (2013)

[20] João Loureiro, Manuel M.F. Martins, Ana Paula RibeiroJoão Loureiro, Manuel M.F. Martins, Ana Paula Ribeiro (2012), Anchoring to the Euro (and Grouped Together)? The Case of African Countries, *Journal of African Economies*, Vol. 21(1).

[21] Mohamed Siry Bah (2010), Is there a stochastic convergence process in the West African economic and monetary union (WAEMU) in the presence of multiple structural breaks from 1960 to 2010?, *Economics Bulletin Access Economics*, Vol. 34(3).

[22] Harrison Oluchukwu Okafor (2013), Estimating the Costs and Benefits of a Common Currency for the Second West African Monetary Zone (WAMZ), *Journal of Economics and Behavioral Studies*, Vol. 5(2).

[23] Godfrey C. Uzonwanne (2012), A Critical Review of the Theory of Optimum Currency Areas: Perspectives for a West African Single *Currency, Journal of Economics*, Vol. 3(2).
[24] Ben S. Bernanke, Jean Boivin, Piotr Eliasz (2005), Measuring the effects of monetary policy: a Factor-Augmented Vector Autoregressive (FAVAR) Approach, *The Quarterly Journal of Economics*, Vol.120 (1).
[25] Arthur F. Burns (1969), *The Business Cycle in a Changing World*, National Bureau of Economic Research (NBER) Macroeconomics Annual, The University of Chicago Press Journals, Chicago, Vol.3 (2).
[26] James H. Stock and Mark W. Watson, (1998), Median Unbiased Estimation of Coefficient Variance in a Time-Varying Parameter Model, *Journal of the American Statistical Association*, Vol.93(441).
[27] Francis X. Diebold, Glenn D. Rudebusch (1994), *Measuring Business Cycles: A Modern Perspective*, National Bureau of Economic Research (NBER) Macroeconomics Annual, NBER Working Paper No. 4643, The University of Chicago Press Journals, Chicago, Vol.3 (2).
[27] Pami Dua, Anirvan Banerji (2006), *Business Cycles in India*, Working paper series, Centre for Development Economics (CDE), Department of Economics, Delhi School of Economics, Working Paper No. 146
[28] Travis J. Berge and Òscar Jordà, (2011), Evaluating the Classification of Economic Activity into Recessions and Expansions, *American Economic Journal*, Vol.3 (2).
[29] Pandey, Radhika, Ila Patnaik, and Ajay Shah, (2017), Dating business cycles in India, *Indian Growth and Development Review*, Vol. 10 (1)..
[30] Zsolt Darvas, Andrew K. Rose, György Szapáry (2005), *Fiscal Divergence and Business Cycle Synchronization: Irresponsibility is Idiosyncratic*, National Bureau of Economic Research (NBER) Macroeconomics Annual, NBER Working Paper No. 11580, The University of Chicago Press Journals, Chicago, Vol.3(2).
[31] ibid.,, Marco Del Negro and Christopher Otrok (2008)
[32] ibid., Hyeon-seung Huh, David Kim, Won Joong Kim, and Cyn-Young Park (2014)
[33] Sims, Christopher A, (2002), Solving linear rational expectations models, *Computational economics*, Vol.20 (1).
[34] Del Negro, M., and Otrok, C. (2008). Dynamic factor models with time-varying parameters: measuring changes in international business cycles. *FRB of New York Staff Report*, (326).
[35] ibid., Hyeon-seung Huh, David Kim, Won Joong Kim, and Cyn-Young Park (2014)
[36] King, R. G., Stock, J. H., & Watson, M. W. (1995). Temporal instability of the unemployment-inflation relationship. *Economic Perspectives*, Vol.*19*(3).
[37] **I**bid., Ben S. Bernanke, Jean Boivin, Piotr Eliasz (2005)
[38] Bagliano, F. C., & Morana, C. (2008). Factor vector autoregressive estimation: a new approach. *Journal of economic interaction and coordination*, *3*(1), 15.
[39] Ibid., Hyeon-seung Huh, David Kim, Won Joong Kim, and Cyn-Young Park (2014)
[40] Franses, P. H., and Boswijk, P. (1992). Dynamic specification and cointegration. *Oxford Bulletin of Economics and Statistics*, 369-382.
[41] Ibid., Hyeon-seung Huh, David Kim, Won Joong Kim, and Cyn-Young Park (2014)
[42] Ibid., King, R. G., Stock, J. H., & Watson, M. W. (1995).
[43] Pearson, Karl. (1901). XI. Mathematical contributions to the theory of evolution.—X. Supplement to a memoir on skew variation. *Philosophical Transactions of the Royal Society of London. Series A, Containing Papers of a Mathematical or Physical Character*, *197* (287-299), 443-459.
[44] Cook, S., & Manning, N. (2004). Lag optimisation and finite-sample size distortion of unit root tests. *Economics Letters*, Vol. *84*(2).
[45] Ben S.Bernanke and Jean Boivin, (2003), Monetary policy in a data-rich environment, *Journal of Monetary Economics*, Vol. 50 (3).
[47] Sergent, P. (1979). *Abstract on harmonic decompositions of Dirichlet forms* (No. IPNO-TH--79-1). Paris-11 Univ..
[46] Geweke, J. (1977). The dynamic factor analysis of economic time series. *Latent variables in socio-economic models*.
[47] Stock, J. H., and Watson, M. W. (1999). Forecasting inflation. *Journal of Monetary Economics*, Vol. *44*(2).
[48] **I**bid., Ben S. Bernanke, Jean Boivin, Piotr Eliasz (2005)
[49] James H. Stock, and Mark W. Watson (2002a), Macroeconomic Forecasting Using Diffusion Indexes, *Journal of Business and Economic Statistics*, Vol.20 (2).
[50] James H. Stock, and Mark W. Watson (2002b), Forecasting Using Principal Components From a Large Number of Predictors, *Journal of the American Statistical Association*, Vol. 97 (460).

[51] Sandra Eickmeier and Jörg Breitung, (2005), *How Synchronized are New EU Member States with the Euro Area? Evidence from a Structural Factor Mode*l, Bundesbank Discussion Paper series-1, Bundesbank Discussion Paper No. 20/2005, Deutsche Bundesbank, Germany.

[52] Sandra Eickmeier, (2009), Co-movements and heterogeneity in the euro area analyzed in a non-stationary dynamic factor model, *Journal of Applied Econometrics*, Vol.24 (6).

[55] James H. Stock and Mark W.Watson (2008), *Forecasting in dynamic factor models subject to structural instability*, Prepared for the Conference in Honor of David Hendry, August 23-25, 2007, Oxford press, oxford, USA. This research was funded in part by NSF grant SBR-0617811.

[53] Del Negro, M., & Otrok, C. (2008). Dynamic factor models with time-varying parameters: measuring changes in international business cycles. *FRB of New York Staff Report*, (326).

[54] Pooyan Amir Ahmadi, (2009), *Credit Shocks, Monetary Policy, and Business Cycles: Evidence from a Structural Time Varying Bayesian FAVAR*, Department of Economics, Humboldt University of Berlin, Job Marker Paper, November 2009.

[55] Ibid., Bagliano, F. C., & Morana, C. (2008)

[56] Stock, J. H., & Watson, M. W. (2010). Indicators for dating business cycles: Cross-history selection and comparisons. *American Economic Review*, Vol.*100*(2).

[57] Pellényi, Gábor, (2012), *The sectoral effects of monetary policy in Hungary: A structural factor analysis*, MNB Working Papers, Magyar Nemzeti Bank, The Central Bank of Hungary, Budapest, MNB Working Papers 2012/1

[58] ibid., Hyeon-seung Huh, David Kim, Won Joong Kim, and Cyn-Young Park (2014)

[59] Sims, C. A. (1980). Macroeconomics and reality. *Econometrica: Journal of the Econometric Society*, Vol.1 (48).

[60] Herman O. Wold, (1969), Econometrics as Pioneering in Nonexperimental Model Building, *Econometrica*, Vol. 37 (3).