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TRADE FLOWS, OPTIMAL MACROECONOMIC POLICY AND BUSINESS CYCLES SYNCHRONIZATION IN WEST AFRICA MONETARY ZONE

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Abstract

This work provides an answer to the possibility of creating a second West African monetary union in West Africa. The business cycles in the West African Monetary Zone (WAMZ) using real GDP growth within 1980-2022, detrended by Hodrick–Prescott filters were analyzed. This work also examined the effect of the level of symmetry in macroeconomic policies and the level of symmetry in trade flows on the level of synchronization of business cycles between pairs of countries in WAMZ, the seemingly unrelated regression estimation was computed on Autoregressive Distributed Lag models. The cusum of squares test indicated the absence of structural breaks in the models while the system Portmanteau test for autocorrelation indicated the absence of serial correlations up to the 10th order lag. The empirical results provide clear support for Ghana, Guinea and Nigeria to proceed in the creation of the second West African monetary union with their various currencies tied to the WAMZ-eco while also creating an enabling environment for other countries within WAMZ to join in due course. The cyclical thrift scheme for ECOWAS countries to boost industrialization and trade protection/restriction was also recommended.

JEL Classification: C32, C51, E32, F15, F42, F53.

Keywords: Trade-Flows, Macroeconomic Policy, Business Cycles, Synchronization

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1. INTRODUCTION

Since May 1975 when the Economic Community of West African States (ECOWAS) was established, there has been a progressive movement towards the creation of a monetary union in West Africa. For the French-speaking West African region, there exists the West African Economic and Monetary Union (WAEMU), created in 1994 and is comprised of Benin, Burkina Faso, Cote d'Ivoire, Mali, Niger, Senegal, Togo and Guinea Bissau the only Portuguese speaking country. They have the Central Bank of West African States, in French meaning *Banque Centrale des Etats de l'Afrique de l'Ouest* (BCEAO) with a single currency known as the West African CFA franc, which is tied to the *euro* and guaranteed by the French treasury. For the English-speaking West African region, the West African Monetary Zone (WAMZ) created in the year 2000 has multiple central banks and multiple currencies. Gambia uses the Gambian dalasi, Liberia uses the Liberian dollar, Nigeria uses the Nigerian naira, Sierra Leone uses Sierra Leonean leone, Ghana uses the Ghanaian cedi, while Guinea the only Francophone country under WAMZ uses the Guinean franc (Tapsoba, 2009).

It has been on the agenda of ECOWAS to set up a second West African monetary union under the umbrella of WAMZ, which would eventually merge with WAEMU as an entity, with a single currency known as the *eco*. This was stated in Article 3 section 2e of the July 1991 treaty as "there shall be an establishment of an economic union through the adoption of common policies in the economic, financial, social and cultural sectors and the creation of a monetary union." As a result of this, a decision with reference number: A/DEC.7/12/99 was taken by the Heads of States Conference and Government, in December 1999, ratifying the adoption of Economic Community of West African States (ECOWAS) macroeconomic convergence criteria to include ten (10) indicators which relate to the real sector, public finance and the external sector. The Primary convergence criteria include a single-digit inflation rate at the end of each year; a fiscal deficit of not more than 4% of the GDP by the year 2000; a central bank deficit-financing of not more than 10% of the previous year's tax revenues; and a gross external reserve that can give import cover for a minimum of three months (WAMI, 2002). The Secondary criteria include the prohibition of new domestic default payments and liquidation of existing ones; tax revenue should be equal to or greater than 20 per cent of the GDP; wage bill to tax revenue equal to or less than 35per cent; public investment to tax revenue equal to or greater than 20per cent; a stable real exchange rate; and a positive real interest rate (WAMI, 2002).

These macroeconomic convergence criteria remained the eligibility for member countries within ECOWAS for inclusion in the potential monetary union. As a result, January 2003 was initially due to be the commencement date of the monetary unification but the process was postponed to July 1, 2005, following the poor status of macroeconomic convergence (Essien, 2009), then to December 1, 2009, then to on or before January 2015 and then to 2020. Recently, ECOWAS Heads of State and Governments have compromised the convergence criteria by scaling them down to six (three primary and three secondary

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criteria) with an ultimate goal of merging both the WAMZ (Gambia, Ghana, Guinea, Nigeria, Liberia and Sierra Leone) and WAEMU (Benin, Burkina Faso, Côte d'Ivoire, Mali, Niger, Senegal and Togo) into a single monetary zone by January 2020. The new primary criteria demand that every member country's budget deficit should not be more than 3% of gross domestic product (GDP); the average annual inflation rate should be single-digit of not more than 5% by 2019; and gross reserves should not be less than three months of imports. The secondary criteria require that the public debt to GDP ratio should not be more than 70%; Central Bank financing of budget deficit should not exceed 10% of the previous year's tax revenue; and nominal exchange rate variation should be within +/- 10% (see BusinessNews Staff, 2014; Ordu, 2019). Not minding the various levels of compatibility of ECOWAS countries, the WAEMU region went ahead to violate the ECOWAS agreement in late December 2019, by agreeing with France to rename the CFA franc currency the eco and to reduce the currency's ties to France. The eco would remain pegged to the euro, but the Central Bank of West African States will no longer be required to keep 50 per cent of its foreign reserves in the French Treasury. There would also no longer be a French representative on the West African central bank's board (Madden, 2020).

The probability that the required outcomes of ECOWAS macroeconomic convergence criteria over the possible outcomes will eventually lead to a viable second West African monetary union suggests the usefulness in analyzing the feasibility of this potential monetary union. An inquiry into the feasibility of a monetary union in West Africa given that the ECOWAS macroeconomic convergence criteria and standards of the Optimum Currency Area (OCA) criteria may be augmented is indeed inevitable. A quest on incorporating the cyclical thrift scheme (CTS) where monetary contributions are made by member countries or groups for a particular purpose, in these criteria might proffer clues for deep economic thinking (Opue & Madueme, 2021; Opue & Odu, 2021).

Under the OCA criteria, there are three classic economic criteria and an additional three that are political. The classic economic criteria hinge on the fact that: optimum currency areas are those within which people move easily; production and export are widely diversified and of similar structure between countries; and thirdly, countries are very open to trade and trade heavily with each other. The political criteria hinge on the fact that: countries must agree to compensate each other for adverse shocks; currency union member countries must share a wide consensus on the way to deal with shocks; and thirdly when the common monetary policy gives rise to conflicts of national interests, the countries that form a currency area need to accept the costs in the name of a common destiny (Mundell, 1961; McKinnon, 1963; Kenen, 1969; Eichengreen, 1991; Baldwin & Wyplosz, 2009). It is noteworthy that both the ECOWAS macroeconomic convergence criteria and the optimum currency area criteria all bother on issues in trade flows as well as similarity in trade flows, macroeconomic policy as well as similarity in macroeconomic policy and production as well as similarity in production, and these are all aimed at the monetary cum economic integration of West Africa, hence, the synchronization of her business cycles (Alesina, Barro & Tenreyro, 2002; Bayoumi, 1994; Frankel & Rose, 1997;

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Kouparitas, 2001). Hence, the need for an examination of trade flows, optimal macroeconomic policy and business cycle synchronization in West Africa.

Research findings reveal that bi-directionally, a monetary union could induce regional business cycle synchronization by stimulating regional symmetry in trade flows and increasing the credibility/optimality of her complementary macroeconomic policies. On the other hand, regional symmetry in trade flows accompanied by credible/optimal macroeconomic policies could synchronize regional business cycles thereby creating a condition suitable for monetary integration (Krugman, 1993; Obstfeld & Rogoff, 2000; Glick & Rose, 2002; Frankel & Rose, 2002; De Grauwe, 2009; UNCTAD, 2014). These views strengthen the position of Fiess (2005) who affirmed that:

> … if the business cycles are similar/synchronized and shocks are common, then coordination of macro policies can become desirable, with a common currency as the ultimate form of policy coordination. On the other hand, if shocks are predominantly country-specific, then the ability to conduct independent monetary and fiscal policy is usually seen as important in helping an economy adjust to a new equilibrium.

Consequently, this study in its quest for regional integration in West Africa attempts to unravel the level of symmetry in trade flows and optimal macroeconomic policy for business cycle synchronization in the West Africa Monetary Zone. It examines and assesses the WAMZ economy and analyses her business cycle synchronization within the context of Pearson's correlation analysis as well as seemingly unrelated regression analysis (SURE). This approach is completely unique from previous research works done in Africa and other parts of the world because it examines and assesses the WAMZ economy and analyses the effects of the level of symmetry in trade flows and the level of symmetry in macroeconomic policies on her level of business cycles synchronization taking cognizance of key variables prescribed within the context of ECOWAS macroeconomic convergence criteria and the OCA criteria. The analysis is done within the context of seemingly unrelated regression (SURE) on Autoregressive Distributed Lag (ARDL) models on pairs of countries within the WAMZ region. So, doing, the magnitudes of the significant parameter estimate from available results would ascertain the pairs of countries suitable or unsuitable for the formation of the second West African monetary union.

Therefore, the objective of this study is to examine the effect of the level of symmetry in trade flows and the level of symmetry in macroeconomic policies on the level of synchronization of business cycles in the West Africa Monetary Zone.

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2. LITERATURE REVIEW

2.1 Conceptual Literature

This section conceptualizes trade flows, optimal macroeconomic policy, level of symmetry/asymmetry and business cycle synchronization. It addresses their meanings and measurements as used in this work.

Trade flows

Trade flows are the buying and selling of goods and services between countries. It measures the balance of trade or net export, i.e., the number of goods and services a country sells to another country minus the number of goods and services a country buys from another country. This calculation includes all international goods and services transactions and represents a country's trade balance (Long, 2009). A trade surplus is attained where exports exceed imports, but where the reverse is the case, it simply signifies a trade deficit. The measurement for the level of symmetry in trade flows is the correlations of trade flows between two or more countries.

Optimal macroeconomic policy

The implementation of macroeconomic policy is usually through two sets of tools: fiscal and monetary policy. Both forms of policy are used to stabilize the economy, which usually means boosting the economy to the level of GDP consistent with full employment (Mayer, 2002). The essence of optimal macroeconomic policy is to create the best environment for an economy to grow, individuals to engage in profitable actions, and businesses to expand, but when a government fails to use optimal macroeconomic policy, it can result in an unbalanced economy and huge fluctuations in the business cycle.

Macroeconomic policy is optimal if it is symmetric between two or more countries and if a significant increase in this level of symmetry in monetary or fiscal policy would result in an increase in the level of synchronization of business cycles. The measurement for the level of symmetry in monetary policy is the correlation of broad money supply growth between two or more countries, while that for the level of symmetry in fiscal policy is the correlation of fiscal balance to GDP ratio between two or more countries.

Level of symmetry/asymmetry

According to Collins English Dictionary (2014), symmetry/asymmetry implies similarity, correspondence, or balance among systems or parts of a system. In this work, it implies the level of similarity in co-movement of business cycles, trade flows as well as macroeconomic policy variables among pair of countries, while the level of asymmetry is the reverse of the level of symmetry and indicates the level of dissimilarity in the co-movement of variables among pair of countries within WAMZ. They are measured with the aid of the Pearson correlation coefficient, where values greater than zero connote symmetry and values less than zero connote asymmetry.

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Business cycles synchronization

Business cycles are fluctuations in aggregate economic activity. There are four stages in a complete business cycle, which are recession, through, expansion and peak. The degree of business cycle synchronization between two countries or regions is the convergence of their economic growth rates over time, characterized by the correlation of the periodic component of real GDP growth. Any value greater than zero implies synchronization of the business cycle. The growth rate of real GDP is the measure of aggregate output. Business cycles are generated by extracting the cyclical components from real GDP growth and the Hodrick-Prescott (HP) filter is the prevailing filtering technique used for the extraction.

2.2 Empirical Literature

The empirical literature expounds on the effects of trade integration/bilateral trade/trade intensity and macroeconomic policy on business cycle synchronization in Europe, Asia and America. In Africa, and above all West Africa, research work in this area is still rare. Most of the findings resulted from different methodologies such as the HP filters, the BP filters, the Generalized Method of Moment, the VAR, SVAR, FAVAR and DSGE models as the case may be. Most of the studies concluded that an increase in trade-integration/bilateral trade and/trade intensity increases business cycles synchronization (Mendoza,1991, 1995; Frankel & Rose, 1998; Fidrmuc, 2001; Bordo & Helbling, 2003; Darvas & Szapary, 2004; De Haan, Inklaar & Jong-A-Pin, 2005; Akin, 2006; Jules-Armand, 2007; Chang, 2011; Pundit, 2011; Grigoli, 2008; Juvenal & Montiero, 2012, etc.). In the same vein, Calderón, Chong and Stein (2002) were of the view that a positive relationship between trade intensity and cycle correlation could potentially be due to both variables being explained by a third factor, namely, the formation of a currency union. And that the impact of trade intensity on cycle correlation is smaller the greater the production structure asymmetries between countries. However, for Artis and Zhang (1999), increased monetary integration was positively related to business cycle synchronization, while Krugman (1993) opined that integration was likely to support specialization according to the comparative advantage.

However, Kumakura (2005) deviated from the point of view of the traditional OCA theory given the speed of globalization among the Asia-Pacific countries by arguing that a monetary union enhances trade and business cycle co-movements among its member countries sufficiently as to obviate the need for national monetary policy. According to his result, although trade was relevant to the business cycles of individual countries, the main determinant of their international correlations was not the geographical structure of their trade but what they produce and export more specifically and the extent to which their output and exports were concentrated on electronic products. His work was one of the first of the kinds that proffered clues on similarities in trade patterns as a determinant factor for the synchronization of business cycles.

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Jules-Armand (2007) argued that the impact of African bilateral trade on BCS was positive and robust. He tested for the 53 African countries over the 1975-2004 period the hypothesis suggesting that monetary integration adds force to bilateral trade intensity which in turn, improves conditions for the practice of common monetary policy throughout business cycles synchronization. In addition to macroeconomic convergence criteria, the promotion of bilateral trade by dropping tariff, non-tariff and infrastructures barriers would accelerate the synchronization of African business cycles and facilitate African monetary integration. More trade thus brings African business cycles closer together and could add force to various projects of monetary integration in progress. Finally, he opined that those results did not consider other possible controls mentioned in recent papers such as the similarity of trade and of productive structure, and that such data were very difficult to collate for African countries. So far, his paper had remained an optimistic view on African monetary integration. It provided some insights on the fact that African MUs could be self-validating through bilateral trade but the aspect of the effects of macroeconomic policies, that is, monetary and fiscal policies on business cycle synchronization were not taken into consideration. His work did not also consider the aspect of the effects of the level of symmetry in trade flows on business cycle synchronization.

Coleman (2011) contributed to the discussion on the long-term sustainability of the embryonic second monetary union in Africa, the West African Monetary Zone (WAMZ). He analyzed the level of economic and monetary integration in West Africa by analyzing the degree of growth cycle synchronization between the five candidate countries over the past thirty years. His empirical approach improves on the standard Pearson Correlation between trend and cyclical components of GDP by analyzing a measure of co-movement at higher frequencies between computed z-scores for all possible pairings of the candidate countries. His results indicated a lack of a consistent pattern of synchronized growth cycles, which raises concerns about the economic sustainability of the WAMZ, as it implies that members may face significant stabilization costs. No investigation was made on issues in trade flows and macroeconomic policies holistically.

On the effect of macroeconomic policies, most research works reviewed revealed that the convergence of macroeconomic policies such as fiscal and monetary policies were systematically linked to business cycles synchronization (Böwer & Guillemineau, 2006; Crespo-Cuaresma, Pfaffermayr, Fernández-Amador & Keppel, 2010; Jidoud, 2012, etc.). However, of all the works reviewed, including the trade theories, none emphasized or addressed the issue of industrialization of UDCs and LDCs in West Africa through the introduction of cyclical thrifts scheme and incentives from reserves/savings from regional countries, to stimulate investment and production, to cushion anticipated distortions/shocks before, during and after monetary integration for symmetry in trade flows and business cycles synchronization, neither did they adopted a seemingly unrelated regression analysis to examine the effect of the level of symmetry in trade flows and level of symmetry in macroeconomic policy on the level of business cycles synchronization between pairs of countries in WAMZ.

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This work covers this gap firstly, by analyzing the level of symmetry in trade flows, the level of symmetry in macroeconomic policies and the level of synchronization of business cycles between pairs of countries within WAMZ. Secondly, the Akaike Information Criteria (AIC) was used to select the best autoregressive distributed lag (ARDL) models for analysis and the seemingly unrelated regression analysis on the system of ARDL models was adopted to investigate the effect of the level of symmetry in trade flows and the level of symmetry in macroeconomic policies on the level of synchronization of business cycles between pairs of countries for WAMZ. The level of symmetry in external reserves as an independent variable was as well introduced to investigate the need for a cyclical thrift scheme, which should offer clues on the need of setting aside a certain percentage of reserves for industrialization and to checkmate distortions that may emerge from trade flows and macroeconomic policy shocks amongst WAMZ countries, while the level of symmetry in FDI inflows and exchange rates are also introduced as independent variables to investigate the strength of unilateral and multilateral currency peg, and should offer clues on the need for a single currency and alignment given the level of synchronization of business cycles within WAMZ region. The various independent variables taken into consideration are introduced based on the prescriptions of the ECOWAS macroeconomic convergence criteria and the optimum currency area criteria.

2.3 Theoretical Literature

1961 was the year Mundell published a revolutionary paper in which he first developed the concept of Optimum Currency Areas (OCA). Important contributions to expounding the theory were later made by McKinnon (1963) and Kenen (1969). In general, the decision to join a currency area involves the abandonment of an independent national monetary policy to follow a unified one. This might involve the creation of a new single currency by a new independent central bank or the fixity of the national mutual exchange rates. In the latter case, a common reserve will be needed for countries to supplement their external positions vis-à-vis other member countries (Cohen, 1992). If the currency area chooses to peg its unified currency (single or multiple) to a key currency (such as the US dollar or euro), it abandons the area's monetary independence for the sake of the key currency's country. Towards this decision, the OCA theory emphasizes on economic integration, that is, the synchronization of business cycles of regional countries as the main aim to join a currency area.

For regional countries to be economically integrated, that is to synchronize their business cycles, the following conditions were prescribed: there have to be free flows of goods and services within the region, i.e., production and export are widely diversified and of similar structure between countries and countries are very open to trade and trade heavily with each other, hence, there should be symmetry in trade flows; there have to be free flows of financial capital (assets) and physical capital; free flows of workers/labour i.e., there exist immigration and emigration; likewise, countries must agree to compensate each other for adverse shocks, currency union member countries must share a wide consensus on the way to deal with shocks and when the common monetary policy gives rise to

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conflicts of national interests, the countries that form a currency area need to accept the costs in the name of a common destiny (Mundell, 1961; McKinnon, 1963; Kenen, 1969; Baldwin & Wyplosz, 2009).

3. METHODOLOGY

3.1 Theoretical Framework

Due to the speed of globalization, external factors have an important influence on trade flows. It is expected that with enhanced international trade, the economic interdependencies become stronger leading to more synchronization of business cycles (BCS), but on the contrary, increased trade may not always lead to BCS between countries. For example, if trade encompasses a vast array of industrial products increased specialization causes the industrial structure of different countries to diverge, implying a divergence of business cycles of trading countries. But for Kose, Prasad and Terrones (2003), if the trade is mainly of intra-industry type or vertical specialization in various stages of production through outsourcing, then greater trade integration is likely to lead to a higher synchronization of business cycles as a result of symmetric industry-specific shocks.

Output co-movements can as well be enhanced if countries trade intensively with the same group of countries within or outside their regions as in the case of West Africa where most countries trade mainly by exporting raw materials to other developed nations and only end up importing finished/processed goods. On this basis, symmetry in the flow of trade could enhance regional business cycle synchronization (Kumakura, 2005).

Mathematically, we have that,

$$\mathrm{BS}_{\mathrm{ijt}} = \mathrm{f}(\mathrm{TF}_{\mathrm{ijt}}) \quad \text{(3.1)}$$

In linear form,

$$\mathrm{BS}_{\mathrm{ijt}} = \beta_0 + \beta_1 \mathrm{TF}_{\mathrm{ijt}} + \varepsilon \quad \text{(3.1b)}$$

where $\beta_1 > 0$

$\mathrm{BS}_{\mathrm{ijt}}$ = Level of synchronization of business cycle between countries i and j., and $\mathrm{TF}_{\mathrm{ijt}}$ = level of symmetry in trade flows between countries i and j at time t.

Also, for a country to be economically integrated as prescribed by the OCA theory there has to be free flows of financial capital (assets) and physical capital which involves the coordination of monetary and fiscal policies to redress interest rates and emerging inflationary shocks. Mundell (1961) and McKinnon (1963) argued that there is a trade-off between two objectives: macroeconomic stabilization (lower inflation vs. full employment) and the reduction of transaction costs (interest rate). An optimal monetary policy would eliminate this trade-off. Given that a country forfeits its national monetary policy to join a monetary union, each member country may use the stabilization tools of fiscal policy (such as income tax) to achieve macroeconomic stabilization. In this case, the magnitude

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of the national fiscal policy will map the idiosyncratic shock hitting a particular country from the flows of capital. Consequently, there are two main negative spillovers in a monetary union; first, the macroeconomic stabilization losses that result from an unsustainable fiscal deficit. The second spillover is the resort of members to monetize their fiscal debts, which depreciates the region's currency and exacerbates its debt-service obligations. Therefore, there is a need for setting ceilings on fiscal deficits and/or coordinating national fiscal policies (Masson & Taylor, 1993). As part of the ECOWAS macroeconomic convergence criteria, a budget deficit to GDP ratio of less than or equal to 4% was prescribed. Cooper and Kempf (2004) proposed the optimal setup for the coordination between the monetary and fiscal policies in a monetary union; in a multiple-currency environment, each country should design its optimal fiscal policy to achieve the synchronization of business cycles, and then use the monetary policy to offset the remaining deviations (from price and output targets). If the country-specific monetary policies are highly correlated, it would be less costly to delegate the monetary policy to one central bank. Then, the coordination of each national fiscal policy with the regional monetary policy would be necessary to mitigate the negative spillovers that could lessen business cycle synchronization.

Mathematically, we have that,

$$\mathrm{BS}_{\mathrm{ijt}} = \mathrm{f}(\mathrm{MP}_{\mathrm{ijt}}, \mathrm{FP}_{\mathrm{ijt}}) \quad \text{(3.2)}$$

In linear form,

$$\mathrm{BS}_{\mathrm{ijt}} = \beta_0 + \beta_1 MP_{\mathrm{ijt}} + \beta_2 FP_{\mathrm{ijt}} + \varepsilon \quad \text{(3.2b)}$$

where $\beta_1 > 0$, $\beta_2 > 0$

$\mathrm{BS}_{\mathrm{ijt}}$ = Level of synchronization of business cycle between countries i and j, $\mathrm{MP}_{\mathrm{ijt}}$ = Level of symmetry in monetary policy between countries i and j at time t and $\mathrm{FP}_{\mathrm{ijt}}$ = Level of symmetry in fiscal policy between countries i and j at time t. For symmetry in fiscal policy, we intend to adopt the ECOWAS criteria of fiscal deficit to RGDP ratio, i.e., $\frac{FBAL_{\mathrm{it}}}{\mathrm{RGDP}_{\mathrm{it}}} \leq 4\%$, and for monetary policy, we also consider the level of symmetry in broad money supply growth.

OCA theory also hinges on the fact that: countries must agree to compensate each other for adverse shocks; currency union member countries must share a wide consensus on the way to deal with shocks; and when the common monetary policy gives rise to conflicts of national interests, the countries that form a currency area need to accept the costs in the name of common destiny. The analysis of the risk-sharing system, mainly through fiscal transfers i.e., fiscal policy may reduce the need for an independent monetary policy. To further emphasize, this work expounds this risk-sharing system by the inclusion of the cyclical thrift scheme, where contributions are made in rotation amongst the member countries of the proposed monetary union before, during and after the formation of the union. To cushion the effects of emerging shocks that could diverge business cycles and

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disintegrate the economies of West Africa, part of the reserves from regional countries could be used as a cyclical thrift. In this scheme, contributions are made by member countries of ECOWAS and redistributed as lump sum among participants in rotation until the cycle is complete without any interest rate being attached. Conditionality in the form of monitoring the beneficiaries to ensure efficiency in the investment/utilization of funds must be emphasized. Part of the proceeds from reserves could be reinvested as loans to non-member countries in order to generate profits that could be used in the long run to cushion the effect of emerging shocks and hence, synchronize the regional business cycle. The ECOWAS macroeconomic convergence criteria recommend an external reserve in months of imports to be greater than or equal to 6%.

In mathematical terms, we have that,

$$\mathrm{BS}_{\mathrm{ijt}} = \mathrm{f}(RSV_{\mathrm{ijt}}) \ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots \quad (3.3)$$

In linear form,

$$\mathrm{BS}_{\mathrm{ijt}} = \beta_0 + \beta_1 RSV_{\mathrm{ijt}} + \varepsilon \ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots \quad (3.3b)$$

where $\beta_1 > 0$

$RSV_{\mathrm{ijt}} =$ Level of symmetry in external reserve to import ratio between countries i and j.

The theory of OCAs also suggests that factors within the area must be mobile, i.e., flows of workers/labour in order for the area to sustain a monetary union. Labor markets must be integrated so that they can react to shocks affecting members within the region. Assume a region is in equilibrium and a sub-region is hit by an adverse productivity or trade flows shock, this sub-region will experience a fall in output and real wage, while the rest of the region remains in equilibrium. Mundell (1961) suggested that workers from the adversely affected sub-region should migrate to the unaffected region in order to enjoy higher wages and employment opportunities. This would cause the real wage to rise in the adversely affected sub-region, while the real wage would fall in the rest of the region due to the labor supply's decrease and increase, respectively. This process would continue until real wage parity is achieved between the two regions. In the alternative, proceeds from cyclical thrift scheme could be plunged into productive investments to boost the inflows of foreign direct investment thereby expanding opportunities for the unemployed labour force. Here the ECOWAS macroeconomic convergence criteria prescribe internally funded public investments/tax revenue ratio to be greater than or equal to 20%. On the basis of this, the mathematical model of the form below is adopted:

$$\mathrm{BS}_{\mathrm{ijt}} = \mathrm{f}\left(RSV_{\mathrm{ijt}}, FDI_{\mathrm{ijt}}\right) \ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots \quad (3.4)$$

In linear form,

$$\mathrm{BS}_{\mathrm{ijt}} = \beta_0 + \beta_1 RSV_{\mathrm{ijt}} + \beta_2 FDI_{\mathrm{ijt}} + \varepsilon \ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots \quad (3.5)$$

Where $\beta_1 > 0$, $\beta_2 > 0$

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RSV_{ijt} = Level of symmetry in external reserve to import ratio between countries i and j; FDI_{ijt} = Level of symmetry in foreign direct investment inflows.

3.2 Model Specification

To address the objective involving an empirical evaluation of the effect of the level of symmetry in trade flows and level of symmetry in macroeconomic policy on the level of synchronization of business cycles in WAMZ region, an augmented cum eclectic Frankel and Rose (1998) model encompassing equations 3.1 to 3.5 is presented as follows:

$$\mathrm{BS_{ijt}} = \mathrm{f(TF_{ijt}, MP_{ijt}, FP_{ijt}, RSV_{ijt}, , FDI_{ijt}, EXR_{ijt}, u_{ijt})} \ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots \text{3.6)}$$

In linear form we present 3.6 as follows:

$$\mathrm{BS_{ijt}} = \beta_0 + \beta_1 \mathrm{TF_{ijt}} + \beta_2 \mathrm{MP_{ijt}} + \beta_3 \mathrm{FP_{ijt}} + \beta_4 \mathrm{RSV_{ijt}} + \beta_5 \mathrm{FDI_{ijt}} + \beta_6 \mathrm{EXR_{ijt}} + + \varepsilon_{it} \ldots \text{(3.7)}$$

Where $\beta_1 > 0, \beta_2 > 0, \beta_3 > 0, \beta_4 > 0, \beta_5 > 0, \beta_6 > 0$.

Where $\mathrm{BS_{ij}}$ represents the Level of synchronization of business cycle between countries i and j, $\mathrm{TF_{ij}}$ is the Level of symmetry in trade flows between countries i and j, $\mathrm{MP_{ij}}$ is Level of symmetry in monetary policy between countries i and j, $\mathrm{FP_{ij}}$ is the Level of symmetry in fiscal policy between countries i and j, while, $\mathrm{RSV_{ijt}}, FDI_{ij}$ and $\mathrm{EXR_{ij}}$ represents the Level of symmetry in external reserve, Level of symmetry in foreign direct investment inflows and the Level of symmetry in index of real exchange rates between countries i and j respectively.

The base model of 3.6 could be adjusted to an autoregressive distributed lag (ARDL) model to provide more efficient estimates if the variables in question are more or less integrated of order zero or order one as the case may be. The Akaike Information Criterion (AIC) would be used to choose the best autoregressive distributed lag models which would then be analyzed using the seemingly unrelated regression technique. The ARDL model of order one is specified in the form:

$$\mathrm{BS_{it}} = \beta_0 + \beta_1 \mathrm{BS_{it-1}} + \beta_2 \mathrm{TF_{it}} + \beta_3 \mathrm{TF_{it-1}} + \beta_4 \mathrm{MP_{it}} + \beta_5 \mathrm{MP_{it-1}} + \beta_6 \mathrm{FP_{it}} + \beta_7 \mathrm{FP_{it-1}} + \beta_8 \mathrm{RSV_{it}} + \beta_9 \mathrm{RSV_{it-1}} + \beta_{10} \mathrm{FDI_{it}} + \beta_{11} \mathrm{FDI_{it-1}} + \beta_{12} \mathrm{EXR_{it}} + \beta_{13} \mathrm{EXR_{it-1}} + \mathrm{e_{it}} \ldots\ldots\ldots\ldots \text{(3.8)}$$

The ARDL model of equation (3.8) for WAMZ consists of 6 countries taking 2 at a time, i.e., $\binom{6}{2}$ which equals 15 equations to simultaneously predict the impact of the level of symmetry in trade flows and level of symmetry in macroeconomic policy on the level of synchronization of business cycles. Where t in equation (3.8) is the time frame and ith terms in each of the variables equals 1, 2, 3, to 15 representing: 1 = correlation between Ghana and Guinea; 2 = correlation between Ghana and Gambia; 3 = correlation between Ghana and Liberia; 4 = correlation between Ghana and Nigeria; 5 = correlation between Ghana and Sierra Leone; 6 = correlation between Guinea and Gambia; 7 = correlation between Guinea and Liberia; 8 = correlation between Guinea and Nigeria; 9 = correlation between Guinea and Sierra Leone; 10 = correlation between Gambia and Liberia; 11 = correlation between Gambia and Nigeria; 12 = correlation between Gambia and Sierra

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Leone; 13 = correlation between Liberia and Nigeria; 14 = correlation between Liberia and Sierra Leone; 15 = correlation between Nigeria and Sierra Leone.

3.3 Definition of variables

Business cycle synchronization (BS)

To measure this variable, the time series correlation coefficient between de-trended Real GDPs growth of country i and j is used as follows (Akin, 2006; Shin & Wang, 2004; Calderón, Chong & Stein, 2002):

$$BS_{ij} = \mathrm{corr}(\mathrm{BC_i}, \mathrm{BC_j})_t = \frac{\mathrm{cov}(\mathrm{y_i^c}, \mathrm{y_j^c})}{\sqrt{\mathrm{var}(\mathrm{y_i^c}).\mathrm{var}(\mathrm{y_j^c})}}$$

The positive coefficient indicates the business cycle synchronization between two counties i and j while its negative sign is an indication of non-synchronization. However, to avoid correlation coefficient to be bounded in the [-1: 1] interval, the correlation was computed over 3-year interval with non-overlapping window, so that the error term in a regression model with those correlation coefficients as dependent variable would be normally distributed. This is aimed at making the inference on estimated results to be unbiased. Where $\mathrm{corr}(\mathrm{y_i^c}, \mathrm{y_j^c})$ is the pair-wise correlation coefficient of the cyclical components of real GDP growth of country i and country j. $\mathrm{y_i^c}$ represents de-trended real GDP growth.

Trade flows similarity index (TF)

Regarding the independent variables, to measure the level of symmetry in trade flows, a correlation coefficient of external trade balance in goods and services of two countries are calculated. For this, the trade flow in each country in the given time period is calculated first and the correlation coefficient between them is then estimated as follows:

$$TF_{ijt} = \mathrm{corr}(\mathrm{TF_i}, \mathrm{TF_j})_t$$

The correlation was computed over 3-year interval with non-overlapping window, so that the error term in a regression models would be normally distributed.

Monetary policy similarity index (MP)

The first measure of macroeconomic policy is the similarity in monetary policy. A correlation coefficient of broad money supply growth of two countries is calculated based on the study of (Shin, et. al, 2004). For this, the growth rate of broad money supply in each country in the given time period is calculated first and the correlation coefficient between money growths is then estimated thus:

$$MP_{ijt} = \mathrm{corr}(\mathrm{MP_i}, \mathrm{MP_j})_t$$

The correlation was computed over 3-year interval with non-overlapping window, so that the error term in a regression models would be normally distributed.

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Fiscal policy similarity index (FP)

The second measure of macroeconomic policy is the similarity in fiscal policy. Fiscal shocks have strong, persistent and positive impact on output. Several papers in the literature have measured similarities in fiscal policy, using correlation coefficient or mean absolute difference of budget deficit to GDP ratios of country i and j for period t. This paper measures similarity index of fiscal policies by looking at the correlation of central government fiscal balance as a percentage of GDP for country i and j:

$$\mathrm{FP_{ij}} = \mathrm{corr}(FP_{it}, FP_{jt})$$

The correlation was computed over 3-year interval with non-overlapping window as well.

Similarity index of external reserve (RSV)

Given that any part of revenue generated and not spent is reserved, and external reserves in months of import is also determined by the cyclical stance of the economy. By implication, as revenues increase in periods of booms, external reserves increase as well and becomes endogenous to business cycles. Therefore, given this limitation as in the case of fiscal surplus, symmetry in reserves between two countries i and j could be correlated thus:

$$RSV_{\mathrm{ij}} = \mathrm{corr}(\frac{RSV_{\mathrm{it}}}{\mathrm{IMP_{it}}}, \frac{RSV_{\mathrm{jt}}}{\mathrm{IMP_{jt}}})$$

Where, RSV is the value of external reserve during months of imports. This way we trace the symmetry in reserves in order to investigate whether or not a certain percentage of proceeds from external reserves could be kept aside from regional countries to create a cyclical thrift scheme.

The correlation was computed over 3-year interval with non-overlapping window as well.

Similarity index of foreign direct investment inflows (FDI)

Another form of synchronizing bilateral business cycles is through domestic investment. Here it is envisioned that proceeds from external reserve could be used to boost industrialization through an expansion of foreign direct investment inflows. This way productivity shocks from trade and macroeconomic policies that could hinder prices and employment could be distorted. Therefore, the correlation of FDI of counties i and j are adopted as the index of FDI inflows, thus:

$$FDI_{ijt} = corr(FDI_i, FDI_j)_t$$

To avoid correlation coefficient to be bounded in the [-1: 1] interval, the correlation was computed over 3-year interval with non-overlapping window as well.

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Similarity index of real exchange rates (EXR)

Another indicator of monetary policy coordination is the stability of bilateral exchange rate. The exchange rate would justify the need for a single currency given the level of similarity in exchange rate that could synchronize business cycles. Here it is measured by the use of Pearson correlation between two regional countries.

$$EXR_{ijt} = corr(EXR_i, EXR_j)_t$$

Where EXR_i is the index of real exchange rate for country i and EXR_i for country j.

The correlation was computed over 3-year interval with non-overlapping window as well.

3.4 Estimation Techniques

Seemingly Unrelated Regression (SURE)

Zellner (1962) developed the Seeming Unrelated Regression (SURE) estimator for estimating models with p > 1 dependent variable that allow for different regressor matrices in each equation (e.g., $\mathrm{X_i} \neq \mathrm{X_j}$) and account for contemporaneous correlation, i.e., $\mathrm{E}(\varepsilon_{it}\varepsilon_{jt}) \neq 0$. In order to simplify notation, all ARDL of order one models of equations (3.8) for WAMZ are stacked into a single SUR equation as follows:

$$\begin{bmatrix} BS_{1t} \\ \mathrm{BS}_{2t} \\ \vdots \\ \mathrm{BS}_{pt} \end{bmatrix} = \begin{bmatrix} BS_{1t-1}TF_{1t}TF_{1t-1}MP_{1t}MP_{1t-1}FP_{1t}FP_{1t-1}RSV_{1t}RSV_{1t-1}FDI_{1t}FDI_{1t-1}EXR_{1t}EXR_{1t-1} & 0 & 0 & 0 & 0 & \cdots & 0 \\ 0 \quad 0 \quad 0 \quad 0 \quad 0 \quad 0 \quad 0 \quad 0 \quad 0 \quad 0 \quad 0 \quad 0 \quad 0 \quad 0 & BS_{2t-1}TF_{2t}TF_{2t-1}MP_{2t} & \cdots & & & 0 \\ \vdots \quad \vdots \quad \vdots \quad \vdots \quad \vdots \quad \vdots \quad \vdots \quad \vdots \quad \vdots \quad \vdots \quad \vdots \quad \vdots \quad \vdots & \vdots & \vdots & \vdots & \vdots & \vdots & 0 \\ 0 \quad 0 \quad 0 \quad 0 \quad 0 \quad 0 \quad 0 \quad 0 \quad 0 \quad 0 \quad 0 \quad 0 \quad 0 & 0 & 0 & 0 & 0 & \cdots & EXR_{pt-1} \end{bmatrix} \begin{bmatrix} \beta_{1t} \\ \beta_{2t} \\ \vdots \\ \beta_{pt} \end{bmatrix} + \begin{bmatrix} \varepsilon_{1t} \\ \varepsilon_{2t} \\ \vdots \\ \varepsilon_{pt} \end{bmatrix} \quad \text{(3.9)}$$

that can be re-written as $\mathrm{y} = \mathrm{x}\beta + \varepsilon$; where the $\mathrm{Y} = (BS_1', BS_2', \ldots, BS_p')'$ is a vector of all stacked dependent variables, X is a block diagonal design matrix with the $\mathrm{i^{th}}$ design matrix $\mathrm{X_i}$ on the $\mathrm{it^{th}}$ block, $\beta = (\beta_1', \beta_2', \ldots, \beta_p')'$ is the vector of the stacked coefficient vectors of all equations, the total number of parameters estimated for all p sub-models is $\mathrm{K} = \sum_{i=1}^{p} k_i$, and $\varepsilon = (\varepsilon_1', \varepsilon_2', \ldots, \varepsilon_p')'$ is the vector of the stacked error vectors of all equations.

The same estimates as by separate single-equation OLS estimations can be obtained by an OLS estimation of the entire system of equations, i.e., $\beta^{OLS} = (\mathrm{X'X})^{-1}\mathrm{X'y}$. The SURE estimator that accounts for interrelations between the single sub-models can be obtained by $\beta^{SUR} = [\mathrm{X'}\Omega^{-1}\mathrm{X}][\mathrm{X'}\Omega^{-1}\mathrm{Y}]$, where Ω^{-1} is a weighting matrix based on the covariance matrix of the error terms $\sum$. This covariance matrix $\sum = [\sigma_{ij}]$ has the elements $\sigma_{ij} = \mathrm{E}[\varepsilon_{in}\varepsilon_{jn}]$, where ε_{in} is the error term of the $\mathrm{n^{th}}$ observation of the $\mathrm{i^{th}}$ equation. Finally, the inverse of the weighting matrix can be calculated by $\Omega = \sum \otimes \mathrm{I_N}$, where $\mathrm{I_N}$ is an $\mathrm{N} \times \mathrm{N}$ identity matrix and $\otimes$ denotes the Kronecker product. However, as the true error terms ε are unknown, they are often replaced by observed residuals, e.g., obtained from OLS estimates, i.e., $\hat{\varepsilon}_i = \mathrm{y_i} - \mathrm{X_i}\beta_i^{OLS}$ so that the elements of the covariance matrix can be

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calculated by: $\hat{\sigma}_{ij} = \frac{\hat{\varepsilon}_i' \hat{\varepsilon}_j}{N}$. Thus, a SURE model is an application of the generalized least squares (GLS) approach and the unknown residual covariance matrix is estimated from the data.

3.5 Sources of Data

The dataset used for this research contains yearly observations dating from 1980 to 2022 due to lack of availability of monthly and quarterly series. The missing observations in the available series were interpolated with the aid of TRAMO/SEATS environment following Gomez and Maravall (1996). The variables sourced for this research includes the following:

Data were sourced from World Development Indicator (WDI) of the World Bank (2022), United Nations Commission on Trade and Development (UNCTAD) database (2022), World Economic Outlook, country database and African Development Bank (ADB) statistics department estimates (2022), World Bank national accounts data, and OECD National Accounts data files (2022).

4. PRESENTATION AND INTERPRETATION OF RESULT

4.1 Interpretation of Augmented Dickey Fuller unit root test for WAMZ

The augmented dickey fuller unit roots test was performed on the variables of the study and the test indicated that some of the variables in each of the equations specified for WAMZ were integrated of order zero while some were integrated of order one at 5% level of significance (See Appendix A).

APPENDIX A: Augmented Dickey Fuller Unit root test for West African Monetary Zone (WAMZ)

Unit root test for the variables in the Level of synchronization of business cycle equation between Ghana and Guinea

Variable	Level		First difference		I
	τ	5%	τ	5%	
BS	-4.8626	-3.0522	-6.7632	-3.0810	I(0)
TF	-0.4340	-3.0989	-11.4107	-3.0989	I(1)
MP	-5.9839	-3.0522	-7.5805	-3.0656	I(0)
FP	-3.4649	-3.0522	-5.2048	-3.0656	I(0)
RSV	-3.8977	-3.0522	-6.4974	-3.0810	I(0)
FDI	-4.6606	-3.0522	-7.1546	-3.0656	I(0)
EXR	-4.2419	-3.0522	-9.3929	-3.0656	I(0)

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Unit root test for the variables in the Level of synchronization of business cycle equation between Ghana and Gambia

Variable	Level		First difference		I
	τ	5%	τ	5%	
BS	-4.598	-3.0522	-5.1595	-3.081	I(0)
TF	-2.9995	-3.0522	-6.8944	-3.0656	I(1)
MP	-4.4567	-3.0656	-6.2124	-3.0989	I(0)
FP	-2.6589	-3.0522	-5.8142	-3.0656	I(1)
RSV	-3.2649	-3.0522	-7.7776	-3.0656	I(0)
FDI	-4.8973	-3.0522	-7.0273	-3.0656	I(0)
EXR	-10.079	-3.0522	-8.3185	-3.0656	I(0)

Unit root test for the variables in the Level of synchronization of business cycle equation between Ghana and Liberia

Variable	Level		First difference		I
	τ	5%	τ	5%	
BS	-4.9516	-3.0522	-4.5617	-3.0810	I(0)
TF	-4.0832	-3.0522	-5.4612	-3.0810	I(0)
MP	-2.8875	-3.0522	-5.1182	-3.0656	I(1)
FP	-5.4647	-3.0522	-4.6326	-3.0989	I(0)
RSV	-4.2857	-3.0522	-6.0231	-3.0810	I(0)
FDI	-3.4065	-3.0522	-5.1535	-3.0656	I(0)
EXR	-3.0686	-3.0656	-4.0972	-3.0810	I(0)

Note: τ= computed t-value; 5% = critical value; I = order of integration; I(0) = integrated of order zero; I(1) = integrated of order one.

BS- Level of synchronization of business cycle between country pair; TF- Level of symmetry in trade flows between country pair; MP- Level of symmetry in monetary policy between country pair; FP- Level of symmetry in fiscal policy between country pair; RSV- Level of symmetry in external reserve between country pair; FDI- Level of symmetry in foreign direct investment inflows between country pair; EXR- Level of symmetry in real exchange rate index between country pair

(Source: Author's computation)

Unit root test for the variables in the Level of synchronization of business cycle equation between Ghana and Nigeria

Variable	Level		First difference		I
	τ	5%	τ	5%	
BS	-4.7701	-3.0656	-5.5760	-3.0810	I(0)
TF	-4.5599	-3.0522	-4.4483	-3.1199	I(0)
MP	-5.1053	-3.0522	-7.0234	-3.0810	I(0)
FP	-3.9467	-3.0522	-5.7472	-3.0989	I(0)
RSV	-6.5550	-3.0522	-4.9018	-3.0810	I(0)
FDI	-3.0670	-3.0656	-3.6760	-3.0810	I(0)
EXR	-2.5077	-3.0522	-3.8609	-3.0656	I(1)

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Unit root test for the variables in the Level of synchronization of business cycle equation between Ghana and Sierra Leone

Variable	Level		First difference		I
	τ	5%	τ	5%	
BS	-3.5954	-3.0522	-6.8002	-3.0656	I(0)
TF	-6.1340	-3.0522	-6.1606	-3.0810	I(0)
MP	-3.6767	-3.0522	-6.4250	-3.0656	I(0)
FP	-4.1974	-3.0522	-4.2991	-3.0810	I(0)
RSV	-4.8251	-3.0522	-7.6046	-3.0656	I(0)
FDI	-1.7438	-3.0522	-4.8156	-3.0810	I(1)
EXR	-3.4169	-3.0522	-5.3992	-3.0656	I(0)

Unit root test for the variables in the Level of synchronization of business cycle equation between Guinea and Gambia

Variable	Level		First difference		I
	τ	5%	τ	5%	
BS	-4.1048	-3.0522	-5.6591	-3.0810	I(0)
TF	-5.5786	-3.0522	-3.1329	-3.1199	I(0)
MP	-2.5918	-3.0522	-5.6790	-3.0656	I(1)
FP	-3.6787	-3.0522	-6.0577	-3.0810	I(0)
RSV	-3.0440	-3.0522	-7.2750	-3.0656	I(1)
FDI	-3.3701	-3.0810	-4.0674	-3.1199	I(0)
EXR	-4.1188	-3.0522	-6.2295	-3.0656	I(0)

Note: τ= computed t-value; 5% = critical value; I = order of integration; I(0) = integrated of order zero; I(1) = integrated of order one.

BS- Level of synchronization of business cycle between country pair; TF- Level of symmetry in trade flows between country pair; MP- Level of symmetry in monetary policy between country pair; FP- Level of symmetry in fiscal policy between country pair; RSV- Level of symmetry in external reserve between country pair; FDI- Level of symmetry in foreign direct investment inflows between country pair; EXR- Level of symmetry in real exchange rate index between country pair

(Source: Author's computation)

Unit root test for the variables in the Level of synchronization of business cycle equation between Guinea and Liberia

Variable	Level		First difference		I
	τ	5%	τ	5%	
BS	-3.8700	-3.0522	-5.3955	-3.0656	I(0)
TF	-5.9129	-3.0522	-10.1126	-3.0656	I(0)
MP	-4.9099	-3.0522	-7.2414	-3.0656	I(0)
FP	-3.3959	-3.0522	-3.9626	-3.0989	I(0)
RSV	-0.3610	-3.0810	-5.4268	-3.0810	I(1)
FDI	-4.8278	-3.0522	-7.2583	-3.0656	I(0)
EXR	-2.6131	-3.0656	-4.4825	-3.0810	I(1)

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Unit root test for the variables in the Level of synchronization of business cycle equation between Guinea and Nigeria

Variable	Level		First difference		I
	τ	5%	τ	5%	
BS	-3.0475	-3.0522	-6.2259	-3.0656	I(1)
TF	-5.2582	-3.0656	-6.4701	-3.0810	I(0)
MP	-1.6378	-3.0656	-4.1793	-3.0989	I(1)
FP	-3.8699	-3.0989	-3.5468	-3.0656	I(0)
RSV	-3.7347	-3.0989	-4.1958	-3.0810	I(0)
FDI	-4.7024	-3.0989	-6.8607	-3.0810	I(0)
EXR	-2.8474	-3.0522	-4.6117	-3.1199	I(1)

Unit root test for the variables in the Level of synchronization of business cycle equation between Guinea and Sierra Leone

Variable	Level		First difference		I
	τ	5%	τ	5%	
BS	-3.6890	-3.0522	-4.4210	-3.0989	I(0)
TF	-4.5447	-3.0656	-4.0627	-3.0989	I(0)
MP	-3.6880	-3.0522	-5.7427	-3.0656	I(0)
FP	-4.9192	-3.0522	-7.3635	-3.0656	I(0)
RSV	-2.4334	-3.0522	-4.9605	-3.0656	I(1)
FDI	-5.6945	-3.0656	-7.7046	-3.0810	I(0)
EXR	-4.1361	-3.0522	-7.2961	-3.0656	I(0)

Note: τ= computed t-value; 5% = critical value; I = order of integration; I(0) = integrated of order zero; I(1) = integrated of order one.

BS- Level of synchronization of business cycle between country pair; TF- Level of symmetry in trade flows between country pair; MP- Level of symmetry in monetary policy between country pair; FP- Level of symmetry in fiscal policy between country pair; RSV- Level of symmetry in external reserve between country pair; FDI- Level of symmetry in foreign direct investment inflows between country pair; EXR- Level of symmetry in real exchange rate index between country pair

(Source: Author's computation)

Unit root test for the variables in the Level of synchronization of business cycle equation between Gambia and Liberia

Variable	Level		First difference		I
	τ	5%	τ	5%	
BS	-4.9806	-3.0522	-3.7236	-3.1199	I(0)
TF	-4.0231	-3.0522	-6.3142	-3.0656	I(0)
MP	-4.4288	-3.0522	-6.0119	-3.0810	I(0)
FP	-4.4963	-3.0522	-4.7426	-3.1199	I(0)
RSV	-4.4733	-3.0522	-5.0130	-3.0810	I(0)
FDI	-4.6753	-3.0989	-3.8404	-3.1199	I(0)
EXR	-3.6105	-3.0522	-3.8450	-3.0810	I(0)

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Unit root test for the variables in the Level of synchronization of business cycle equation between Gambia and Nigeria

Variable	Level		First difference		I
	τ	5%	τ	5%	
BS	-3.2626	-3.0522	-4.7444	-3.0810	I(0)
TF	-4.2146	-3.0810	-5.1747	-3.0989	I(0)
MP	-4.3209	-3.0522	-7.2654	-3.0656	I(0)
FP	-3.6596	-3.0522	-5.2330	-3.0656	I(0)
RSV	-3.5195	-3.0522	-7.0851	-3.0656	I(0)
FDI	-4.1326	-3.0522	-8.7861	-3.0656	I(0)
EXR	-2.6713	-3.0522	-5.1957	-3.0656	I(1)

Unit root test for the variables in the Level of synchronization of business cycle equation between Gambia and Sierra Leone

Variable	Level		First difference		I
	τ	5%	τ	5%	
BS	-5.0298	-3.0656	-5.1547	-3.1199	I(0)
TF	-3.7412	-3.0810	-4.3950	-3.0989	I(0)
MP	-2.9277	-3.0522	-5.4513	-3.0656	I(1)
FP	-3.9158	-3.0522	-5.9794	-3.0656	I(0)
RSV	-3.4195	-3.0522	-3.7787	-3.1199	I(0)
FDI	-5.2786	-3.0522	-5.7779	-3.0810	I(0)
EXR	-4.9164	-3.0522	-5.4569	-3.0810	I(0)

Note: τ= computed t-value; 5% = critical value; I = order of integration; I(0) = integrated of order zero; I(1) = integrated of order one.

BS- Level of synchronization of business cycle between country pair; TF- Level of symmetry in trade flows between country pair; MP- Level of symmetry in monetary policy between country pair; FP- Level of symmetry in fiscal policy between country pair; RSV- Level of symmetry in external reserve between country pair; FDI- Level of symmetry in foreign direct investment inflows between country pair; EXR- Level of symmetry in real exchange rate index between country pair

(Source: Author's computation)

Unit root test for the variables in the Level of synchronization of business cycle equation between Liberia and Nigeria

Variable	Level		First difference		I
	τ	5%	τ	5%	
BS	-3.5841	-3.0522	-5.2508	-3.0810	I(0)
TF	-3.9228	-3.0522	-5.6101	-3.0656	I(0)
MP	-3.1405	-3.0522	-4.5300	-3.0810	I(0)
FP	-3.7034	-3.0522	-7.2085	-3.0656	I(0)
RSV	-5.5281	-3.0522	-4.6425	-3.1199	I(0)
FDI	-3.0610	-3.0810	-8.1996	-3.0656	I(1)
EXR	-3.2233	-3.0656	-3.3942	-3.0656	I(0)

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Unit root test for the variables in the Level of synchronization of business cycle equation between Liberia and Sierra Leone

Variable	Level		First difference		I
	τ	5%	τ	5%	
BS	-3.6989	-3.0522	-6.0251	-3.0810	I(0)
TF	-5.6916	-3.0522	-4.7273	-3.0989	I(0)
MP	-2.8944	-3.0522	-5.4510	-3.0810	I(1)
FP	-3.8616	-3.0522	-3.6104	-3.1199	I(0)
RSV	-1.9276	-3.0522	-4.8323	-3.0810	I(1)
FDI	-2.7874	-3.0522	-4.9660	-3.0810	I(1)
EXR	-3.3420	-3.0522	-5.4602	-3.0656	I(0)

Unit root test for the variables in the Level of synchronization of business cycle equation between Nigeria and Sierra Leone

Variable	Level		First difference		I
	τ	5%	τ	5%	
BS	-2.6955	-3.0522	-4.5995	-3.0656	I(1)
TF	-3.8037	-3.0522	-5.9965	-3.1199	I(0)
MP	-4.5468	-3.0522	-6.7348	-3.0989	I(0)
FP	-3.3336	-3.0522	-4.8119	-3.0810	I(0)
RSV	-5.4073	-3.0522	-4.0066	-3.1199	I(0)
FDI	-4.0900	-3.0522	-4.7446	-3.0810	I(0)
EXR	-2.4907	-3.0522	-4.0232	-3.0656	I(1)

Note: τ= computed t-value; 5% = critical value; I = order of integration; I(0) = integrated of order zero; I(1) = integrated of order one.

BS- Level of synchronization of business cycle between country pair; TF- Level of symmetry in trade flows between country pair; MP- Level of symmetry in monetary policy between country pair; FP- Level of symmetry in fiscal policy between country pair; RSV- Level of symmetry in external reserve between country pair; FDI- Level of symmetry in foreign direct investment inflows between country pair; EXR- Level of symmetry in real exchange rate index between country pair

(Source: Author's computation)

4.2 Interpretation of Cusum of squares test for structural breaks for WAMZ

The cusum of squares test revealed that all the variables in each of the business cycles models embedded in the seemingly unrelated regression equation (SURE) had no structural break (see appendix). This is because the variables in the SURE models lie within the 5 per cent significance boundry. The reason behind this is the fact that the level of synchronization of business cycles and the level of symmetry of the explanatory variables among the pairs of countries for WAMZ were first determined with the aid of Pearson correlation within the three-year non-overlapping window (See Appendix B).

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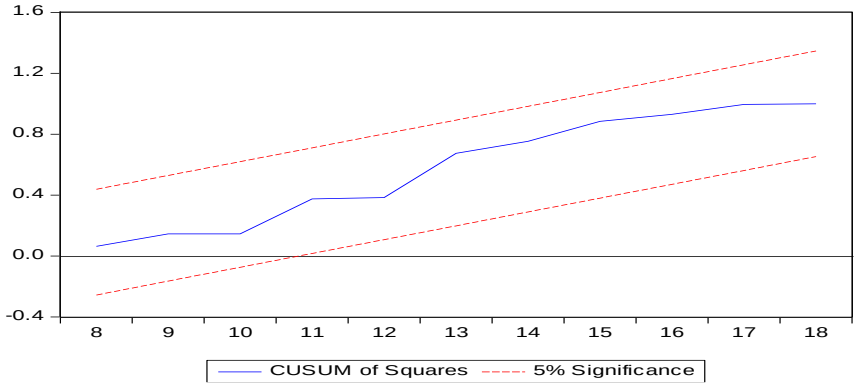
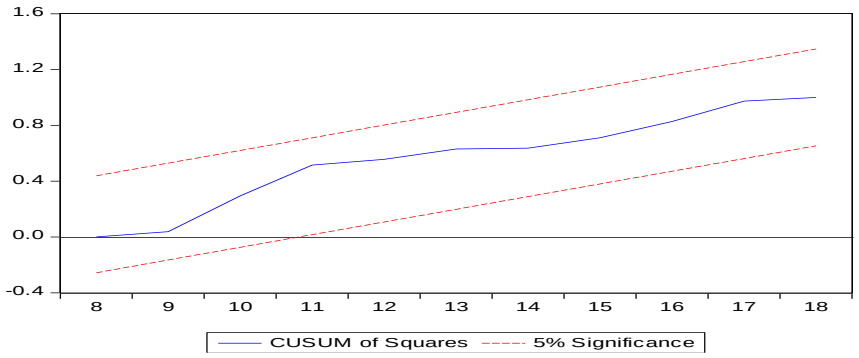
APPENDIX B: Cusum of squares test for structural break for WAMZ

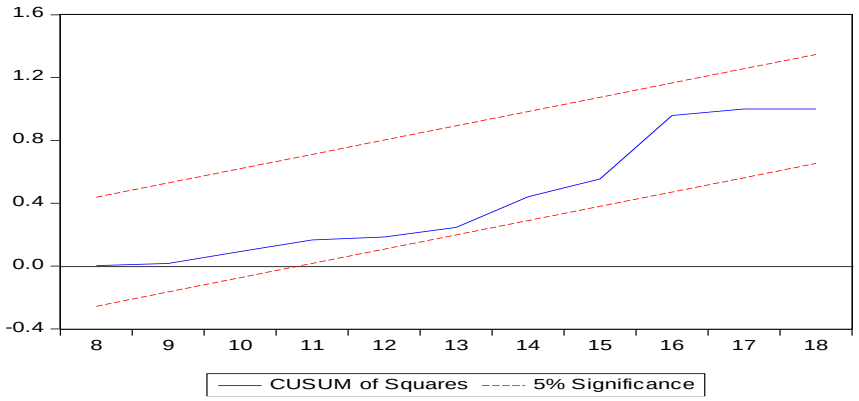
Dependent Variable: Level of business cycles synchronization between Ghana and Guinea (BSGHAGIN)



Dependent Variable: Level of business cycles synchronization between Ghana and Gambia (BSGHAGMB)



Dependent Variable: Level of business cycles synchronization between Ghana and Liberia (BSGHALBR)



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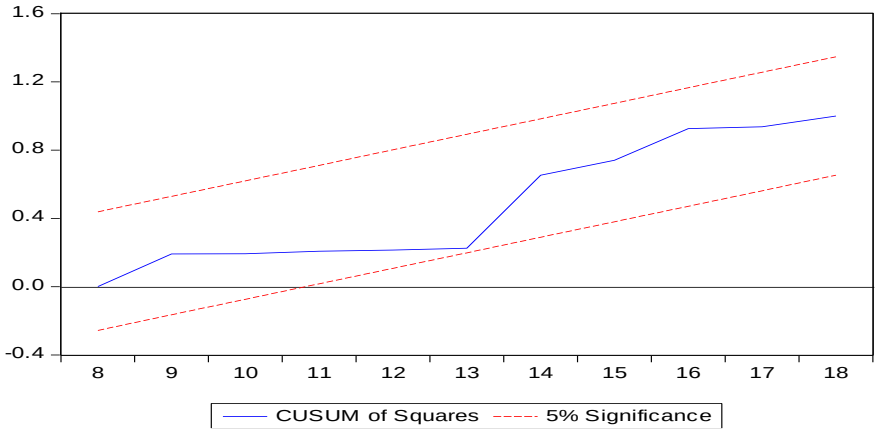
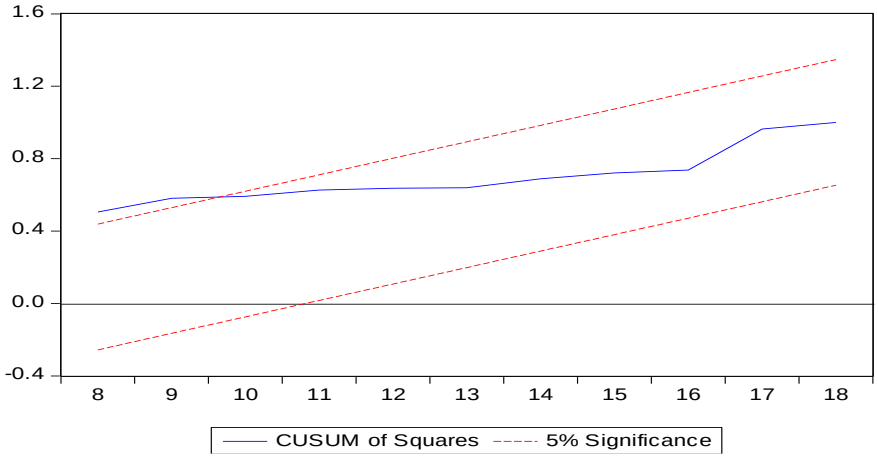
Dependent Variable: Level of business cycles synchronization between Ghana and Nigeria (BSGHANGA)



Dependent Variable: Level of business cycles synchronization between Ghana and Sierra Leone (BSGHASLE)



Chow Breakpoint Test: 8			
Null Hypothesis: No breaks at specified breakpoints			
Varying regressors: All equation variables			
Equation Sample: 1 18			
F-statistic	0.773244	Prob. F(7,4)	0.6413
Log likelihood ratio	15.40379	Prob. Chi-Square(7)	0.1312
Wald Statistic	5.412706	Prob. Chi-Square(7)	0.6097

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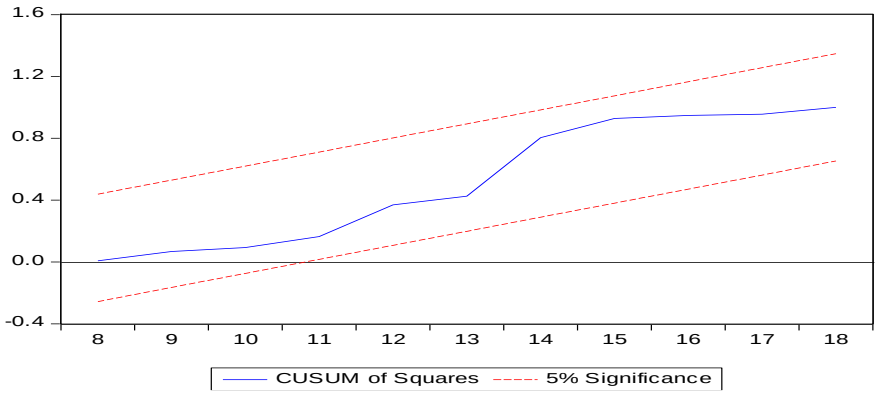
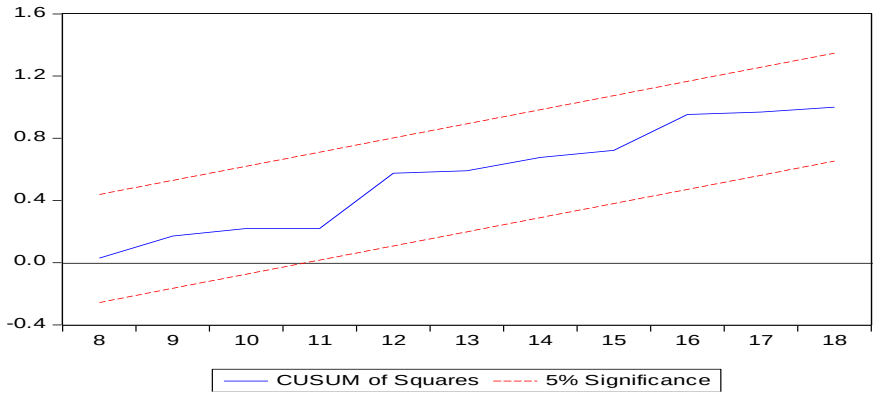
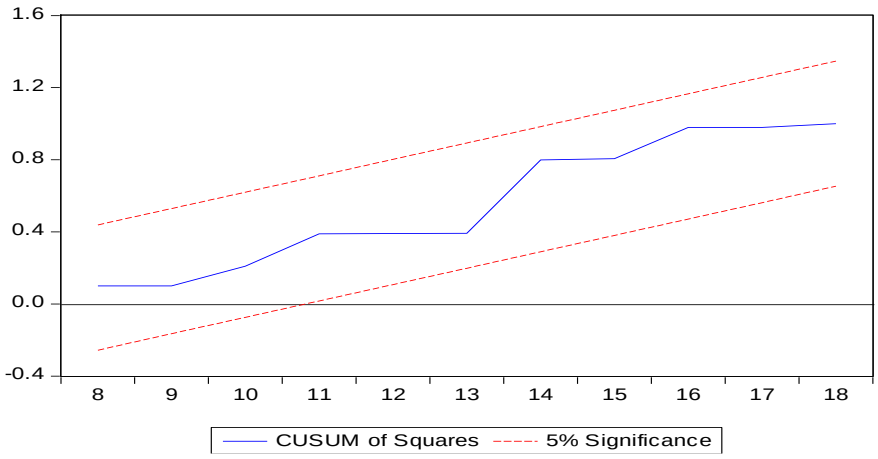
Dependent Variable: Level of business cycles synchronization between Guinea and Gambia (BSGINGMB)



Dependent Variable: Level of business cycles synchronization between Guinea and Liberia (BSGINLBR)



Dependent Variable: Level of business cycles synchronization between Guinea and Nigeria (BSGINNGA)



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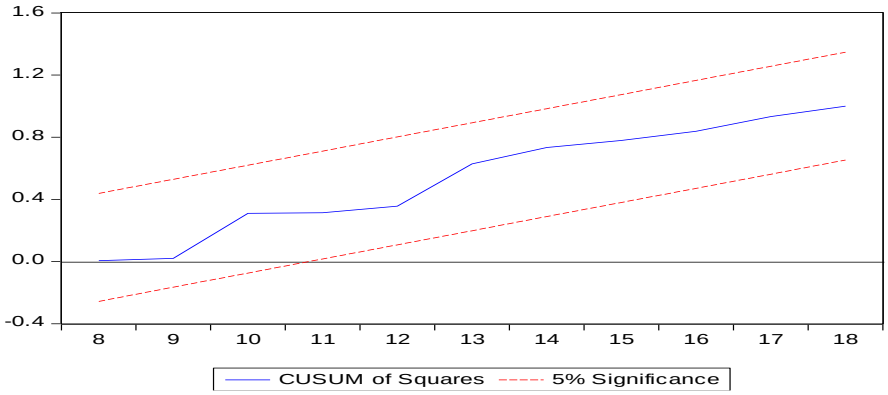
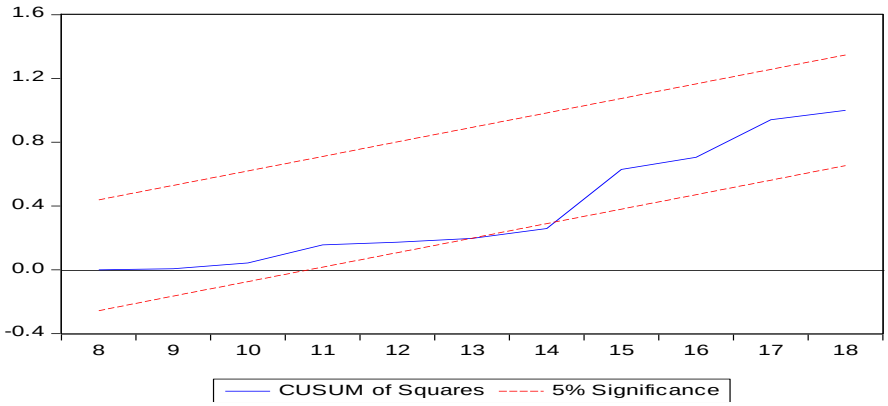
Dependent Variable: Level of business cycles synchronization between Guinea and Sierra Leone (BSGINSLE)



Dependent Variable: Level of business cycles synchronization between Gambia and Liberia (BSGMBLBR)



Chow Breakpoint Test: 8			
Null Hypothesis: No breaks at specified breakpoints			
Varying regressors: All equation variables			
Equation Sample: 1 18			
F-statistic	0.315359	Prob. F(7,4)	0.9127
Log likelihood ratio	7.910380	Prob. Chi-Square(7)	0.3406
Wald Statistic	2.207511	Prob. Chi-Square(7)	0.9475

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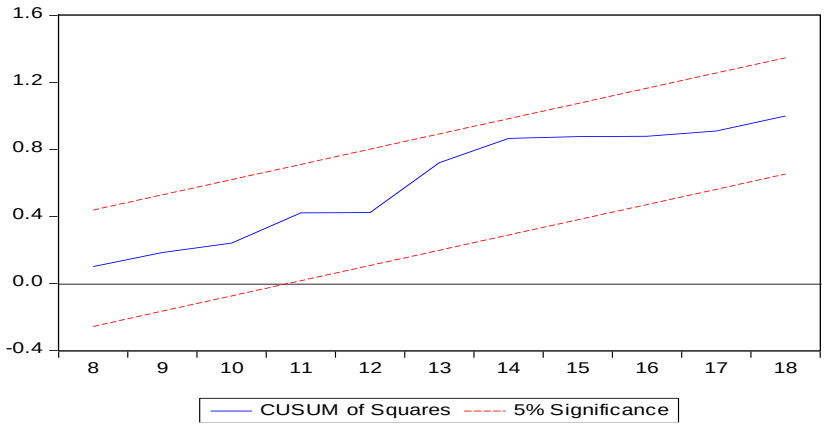
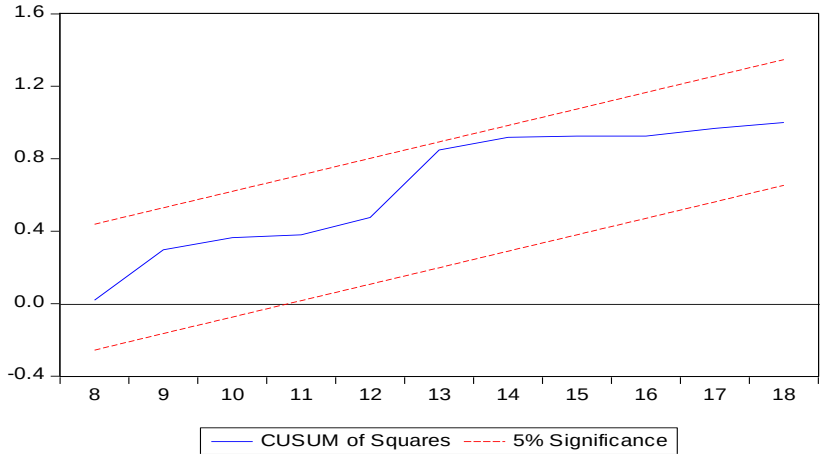
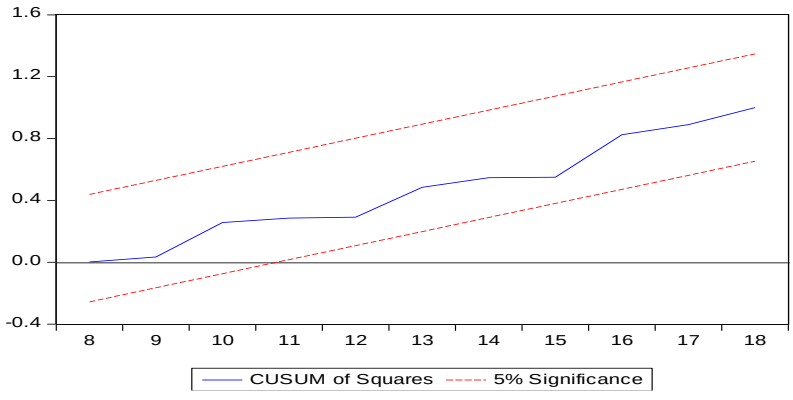
Dependent Variable: Level of business cycles synchronization between Gambia and Nigeria (BSGMBNGA)



Dependent Variable: Level of business cycles synchronization between Gambia and Sierra Leone (BSGMBSLE)



Dependent Variable: Level of business cycles synchronization between Liberia and Nigeria (BSLBRNGA)



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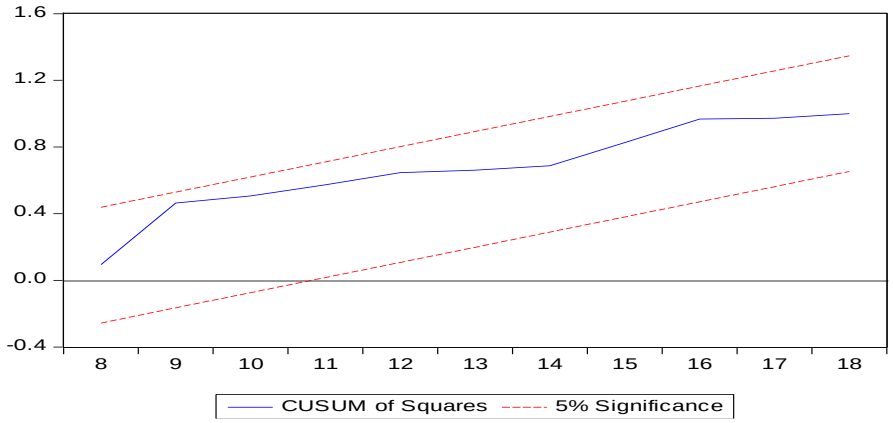
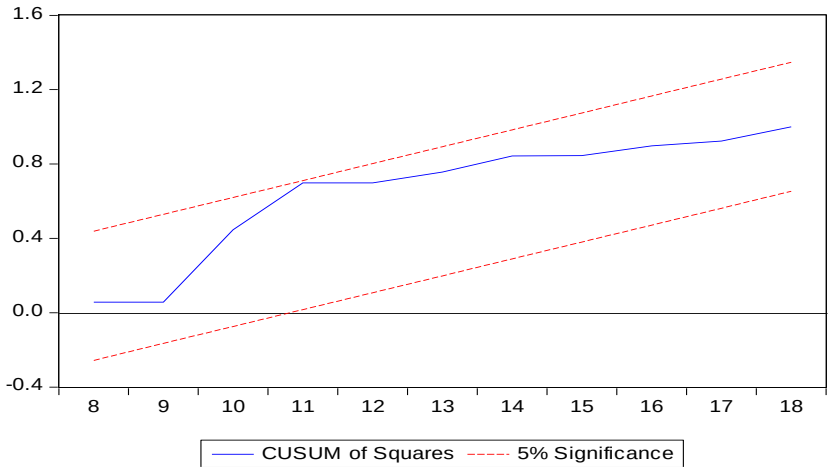
Dependent Variable: Level of business cycles synchronization between Liberia and Sierra Leone (BSLBRSLE)



Dependent Variable: Level of business cycles synchronization between Nigeria and Sierra Leone (BSNGASLE)



4.3 Interpretation of seemingly unrelated regression analysis

The essence of this study was to examine trade flows, optimal macroeconomic policy and business cycles synchronization in West Africa Monetary Zone. However, the seemingly unrelated regression analysis on autoregressive distributed lag models for pairs of countries within WAMZ (See Appendix C) empirically evaluated revealed that some countries within the WAMZ region had very close similarities. In this regard, the results on the whole shows that in a given period, the level of symmetry on trade flows, monetary policy and fiscal policy between pairs of countries would result in a significant increase in the level synchronization of business cycles between the country's pairs both in the immediate as well as one period after. In this situation their macroeconomic policies were optimal. The pairs of countries which fall within this category under WAMZ were: Nigeria-Ghana, Ghana-Guinea and Guinea-Nigeria.

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APPENDIX C: Seemingly Unrelated Regression analysis for WAMZ

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  ___  ____  ____  ____  ____ (R)
 /__    /   ____/   /   ____/
___/   /   /___/   /   /___/   13.0   Copyright 1985-2013 StataCorp LP
  Statistics/Data Analysis             StataCorp
                                       4905 Lakeway Drive
     MP - Parallel Edition             College Station, Texas 77845 USA
                                       800-STATA-PC        http://www.stata.com
                                       979-696-4600        stata@stata.com
```

```
. sureg (bsghagin = L1.bsghagin tfghagin L(0/1).mpghagin L(0/1).fpghagin L(0/1).rsvghagin fdighagin
L(0/1).exrghagin) (bsghagmb = L1.bsghagmb t
> fghagmb mpghagmb L(0/1).fpghagmb rsvghagmb L(0/1).fdighagmb L(0/1).exrghagmb) (bsghalbr =
L1.bsghalbr L(0/1).tfghalbr mpghalbr fpghalbr rsvgh
> albr fdighalbr L(0/1).exrghalbr) (bsghanga = L1.bsghanga L(0/1).tfghanga L(0/1).mpghanga
L(0/1).fpghanga rsvghanga L(0/1).fdighanga L(0/1).ex
> rghanga) (bsghasle = L1.bsghasle L(0/1).tfghasle L(0/1).mpghasle L(0/1).fpghasle L(0/1).rsvghasle
L(0/1).fdighasle L(0/1).exrghasle) (bsgingm
> b = L1.bsgingmb L(0/1).tfgingmb L(0/1).mpgingmb fpgingmb rsvgingmb L(0/1).fdigingmb
L(0/1).exrgingmb) (bsginlbr = L1.bsginlbr tfginlbr mpginl
> br fpginlbr L(0/1).rsvginlbr fdiginlbr exrginlbr) (bsginnga = L1.bsginnga L(0/1).tfginnga
L(0/1).mpginnga L(0/1).fpginnga L(0/1).rsvginnga L(
> 0/1).fdiginnga L(0/1).exrginnga) (bsginsle = L1.bsginsle L(0/1).tfginsle mpginsle fpginsle
L(0/1).rsvginsle fdiginsle exrginsle) (bsgmblbr =
> L1.bsgmblbr L(0/1).tfgmblbr L(0/1).mpgmblbr L(0/1).fpgmblbr L(0/1).rsvgmblbr L(0/1).fdigmblbr
exrgmblbr) (bsgmbnga = L1.bsgmbnga L(0/1).tfgmb
> nga mpgmbnga L(0/1).fpgmbnga rsvgmbnga fdigmbnga exrgmbnga) (bsgmbsle =L1.bsgmbsle tfgmbsle
mpgmbsle fpgmbsle rsvgmbsle L(0/1).fdigmbsle exrg
> mbsle) (bslbrnga = L1.bslbrnga L(0/1).tflbrnga mplbrnga L(0/1).fplbrnga L(0/1).rsvlbrnga
L(0/1).fdilbrnga L(0/1).exrlbrnga) (bslbrsle = L1.bs
> lbrsle tflbrsle mplbrsle L(0/1).fplbrsle rsvlbrsle fdilbrsle L(0/1).exrlbrsle) (bsngasle =
L1.bsngasle L(0/1).tfngasle L(0/1).mpngasle fpngas
> le L(0/1).rsvngasle fdingasle L(0/1).exrngasle), corr
```

Seemingly unrelated regression

Equation	Obs	Parms	RMSE	"R-sq"	chi2	P
bsghagin	17	11	.154219	0.9488	576.91	0.0000
bsghagmb	17	10	.3785747	0.6919	85.57	0.0000
bsghalbr	17	9	.466608	0.5874	38.89	0.0000
bsghanga	17	12	.2691901	0.8053	168.52	0.0000
bsghasle	17	13	.1706666	0.9426	343.01	0.0000
bsgingmb	17	11	.251527	0.8474	135.84	0.0000
bsginlbr	17	8	.5271864	0.5387	28.86	0.0003
bsginnga	17	13	.1689355	0.9343	471.23	0.0000
bsginsle	17	9	.3426357	0.7902	132.55	0.0000
bsgmblbr	17	12	.3312526	0.7692	117.67	0.0000
bsgmbnga	17	9	.4152859	0.6623	73.71	0.0000
bsgmbsle	17	8	.4356973	0.5817	39.12	0.0000
bslbrnga	17	12	.3417907	0.7751	141.64	0.0000
bslbrsle	17	9	.4453783	0.5712	58.11	0.0000
bsngasle	17	11	.1458481	0.9388	430.52	0.0000

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	Coef.	Std. Err.	z	P>|z|	[95% Conf.	Interval]
bsghagin						
bsghagin						
L1.	-.4842439	.0525962	-9.21	0.000	-.5873306	-.3811573
tfghagin	.1056863	.0514346	2.05	0.040	.0048763	.2064963
mpghagin						
--.	.2240736	.1095723	2.04	0.041	.0093157	.4388314
L1.	.9802651	.1183526	8.28	0.000	.7482983	1.212232
fpghagin						
--.	.1028307	.0506843	2.03	0.042	.0034912	.2021701
L1.	-.253298	.0639823	-3.96	0.000	-.3787011	-.127895
rsvghagin						
--.	-.8572315	.0941055	-9.11	0.000	-1.041675	-.6727881
L1.	-.8230803	.0444065	-18.54	0.000	-.9101155	-.7360452
fdighagin	.7799837	.0913375	8.54	0.000	.6009654	.959002
exrghagin						
--.	.0949928	.0825592	1.15	0.250	-.0668202	.2568058
L1.	1.056135	.076015	13.89	0.000	.9071487	1.205122
_cons	-.8691358	.1105228	-7.86	0.000	-1.085756	-.6525151
bsghagmb						
bsghagmb						
L1.	.7726811	.2297015	3.36	0.001	.3224744	1.222888
tfghagmb	.2561025	.2133341	1.20	0.230	-.1620246	.6742296
mpghagmb	-.3161761	.1279963	-2.47	0.014	-.5670443	-.0653079
fpghagmb						
--.	-.8794505	.2274626	-3.87	0.000	-1.325269	-.4336321
L1.	.2873387	.1455609	1.97	0.048	.0020447	.5726328
rsvghagmb	1.177798	.313675	3.75	0.000	.5630068	1.79259
fdighagmb						
--.	.3949707	.2141347	1.84	0.065	-.0247256	.8146671
L1.	.6934641	.1513732	4.58	0.000	.396778	.9901502
exrghagmb						
--.	1.878751	.564882	3.33	0.001	.7716028	2.9859
L1.	-.5971343	.2177557	-2.74	0.006	-1.023928	-.170341
_cons	-1.297307	.4656379	-2.79	0.005	-2.209941	-.3846739
bsghalbr						
bsghalbr						
L1.	-.4438051	.1446622	-3.07	0.002	-.7273378	-.1602725
tfghalbr						
--.	-.0057824	.2697509	-0.02	0.983	-.5344844	.5229197
L1.	.8653778	.2278546	3.80	0.000	.418791	1.311965
mpghalbr	-.0982749	.1551704	-0.63	0.527	-.4024034	.2058535
fpghalbr	.0850305	.1581897	0.54	0.591	-.2250155	.3950766
rsvghalbr	.1777609	.1701865	1.04	0.296	-.1557986	.5113204
fdighalbr	-.8406611	.2431109	-3.46	0.001	-1.31715	-.3641724

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exrghalbr						
--.	.1270054	.1956245	0.65	0.516	-.2564116	.5104225
L1.	-.1719633	.2786191	-0.62	0.537	-.7180468	.3741202
_cons	-.3502101	.224304	-1.56	0.118	-.7898379	.0894176
bsghanga						
bsghanga						
L1.	-.4889444	.1685531	-2.90	0.004	-.8193024	-.1585863
tfghanga						
--.	.8751984	.1761265	4.97	0.000	.5299967	1.2204
L1.	.6411479	.1374239	4.67	0.000	.3718019	.9104938
mpghanga						
--.	.109925	.1085782	1.01	0.311	-.1028845	.3227344
L1.	.7893505	.1948424	4.05	0.000	.4074664	1.171235
fpghanga						
--.	1.173415	.1608137	7.30	0.000	.858226	1.488604
L1.	.8825198	.1081571	8.16	0.000	.6705359	1.094504
rsvghanga	.2513365	.0928746	2.71	0.007	.0693057	.4333673
fdighanga						
--.	-.6593789	.1837791	-3.59	0.000	-1.019579	-.2991786
L1.	1.254454	.2268359	5.53	0.000	.809864	1.699045
exrghanga						
--.	-.9101433	.2287136	-3.98	0.000	-1.358414	-.4618728
L1.	-.3558204	.2136879	-1.67	0.096	-.7746409	.0630001
_cons	.9617211	.1408112	6.83	0.000	.6857362	1.237706
bsghasle						
bsghasle						
L1.	.4548258	.0744309	6.11	0.000	.3089439	.6007077
tfghasle						
--.	.2210923	.0956403	2.31	0.021	.0336408	.4085438
L1.	-.9209811	.1102963	-8.35	0.000	-1.137158	-.7048044
mpghasle						
--.	-.5110977	.0810636	-6.30	0.000	-.6699794	-.3522161
L1.	-.1939131	.0752707	-2.58	0.010	-.341441	-.0463853
fpghasle						
--.	-1.020512	.1029068	-9.92	0.000	-1.222206	-.8188184
L1.	-.5365419	.0863087	-6.22	0.000	-.7057038	-.36738
rsvghasle						
--.	.4232655	.101065	4.19	0.000	.2251817	.6213493
L1.	.8618531	.1057706	8.15	0.000	.6545465	1.06916
fdighasle						
--.	-.119017	.1370617	-0.87	0.385	-.3876529	.1496189
L1.	.501338	.1246647	4.02	0.000	.2569996	.7456764
exrghasle						
--.	-.6218661	.1239357	-5.02	0.000	-.8647756	-.3789567
L1.	-1.636678	.261206	-6.27	0.000	-2.148633	-1.124724
_cons	1.831533	.2594	7.06	0.000	1.323119	2.339948
bsgingmb						

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bsgingmb						
L1.	.1641746	.1257227	1.31	0.192	-.0822374	.4105865
tfgingmb						
--.	.1856242	.1108177	1.68	0.094	-.0315745	.4028229
L1.	-.2828095	.1315269	-2.15	0.032	-.5405975	-.0250214
mpgingmb						
--.	-.0993413	.1304017	-0.76	0.446	-.3549239	.1562412
L1.	-.4283999	.1048427	-4.09	0.000	-.6338878	-.2229119
fpgingmb	.1355472	.1026679	1.32	0.187	-.0656782	.3367727
rsvgingmb	-.0780139	.1018838	-0.77	0.444	-.2777025	.1216746
fdigingmb						
--.	-.3398887	.1022683	-3.32	0.001	-.5403308	-.1394466
L1.	-.3042142	.1086982	-2.80	0.005	-.5172588	-.0911696
exrgingmb						
--.	-.7905629	.1532735	-5.16	0.000	-1.090973	-.4901525
L1.	-.4673307	.1113627	-4.20	0.000	-.6855976	-.2490637
_cons	.9615685	.1919752	5.01	0.000	.5853039	1.337833
bsginlbr						
bsginlbr						
L1.	-.4024231	.1644141	-2.45	0.014	-.7246689	-.0801774
tfginlbr	.9018473	.2693164	3.35	0.001	.3739968	1.429698
mpginlbr	-.2197239	.1608771	-1.37	0.172	-.5350373	.0955894
fpginlbr	-.8951571	.3055645	-2.93	0.003	-1.494052	-.2962618
rsvginlbr						
--.	-.1929492	.1577291	-1.22	0.221	-.5020925	.116194
L1.	-.5781583	.1910965	-3.03	0.002	-.9527006	-.203616
fdiginlbr	.3630392	.1559082	2.33	0.020	.0574646	.6686137
exrginlbr	-.2118419	.2100494	-1.01	0.313	-.6235311	.1998474
_cons	.7301891	.2023573	3.61	0.000	.3335761	1.126802
bsginnga						
bsginnga						
L1.	-.0376921	.1367676	-0.28	0.783	-.3057517	.2303675
tfginnga						
--.	.6432836	.111806	5.75	0.000	.4241478	.8624194
L1.	.7102727	.0832811	8.53	0.000	.5470448	.8735007
mpginnga						
--.	.5767019	.1694158	3.40	0.001	.244653	.9087508
L1.	.7600962	.0889774	8.54	0.000	.5857037	.9344886
fpginnga						
--.	-.0795073	.0648738	-1.23	0.220	-.2066575	.047643
L1.	1.104949	.093292	11.84	0.000	.9221002	1.287798
rsvginnga						
--.	-.1991849	.1033985	-1.93	0.054	-.4018423	.0034725
L1.	.409697	.0891408	4.60	0.000	.2349842	.5844098
fdiginnga						
--.	-.1735975	.128114	-1.36	0.175	-.4246963	.0775014
L1.	-.3530512	.0916685	-3.85	0.000	-.5327181	-.1733842
exrginnga						

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--.	.8876433	.1480221	6.00	0.000	.5975254	1.177761
L1.	-.1873135	.079916	-2.34	0.019	-.343946	-.0306811
_cons	-.7513485	.1230133	-6.11	0.000	-.9924501	-.5102469
bsginsle						
bsginsle						
L1.	-.032771	.1052284	-0.31	0.755	-.2390149	.1734728
tfginsle						
--.	.3042872	.1645567	1.85	0.064	-.0182381	.6268125
L1.	-1.117807	.1505279	-7.43	0.000	-1.412837	-.8227781
mpginsle	-.6059507	.1304483	-4.65	0.000	-.8616247	-.3502766
fpginsle	.7516455	.1595941	4.71	0.000	.4388469	1.064444
rsvginsle						
--.	.3908463	.1173382	3.33	0.001	.1608678	.6208249
L1.	-.6626112	.1195165	-5.54	0.000	-.8968592	-.4283633
fdiginsle	-1.475198	.2622902	-5.62	0.000	-1.989278	-.9611189
exrginsle	.6100669	.1615794	3.78	0.000	.2933771	.9267567
_cons	-.5190161	.1793761	-2.89	0.004	-.8705868	-.1674454
bsgmblbr						
bsgmblbr						
L1.	1.303013	.3027569	4.30	0.000	.7096206	1.896406
tfgmblbr						
--.	-1.140593	.3358928	-3.40	0.001	-1.79893	-.4822549
L1.	-.5786681	.1488321	-3.89	0.000	-.8703737	-.2869625
mpgmblbr						
--.	-1.330196	.2817055	-4.72	0.000	-1.882329	-.7780637
L1.	-.6326418	.2225289	-2.84	0.004	-1.068791	-.1964932
fpgmblbr						
--.	-.1308217	.1980492	-0.66	0.509	-.518991	.2573476
L1.	-.5846332	.1958462	-2.99	0.003	-.9684848	-.2007817
rsvgmblbr						
--.	.8681658	.1504289	5.77	0.000	.5733306	1.163001
L1.	-.7358424	.2854612	-2.58	0.010	-1.295336	-.1763488
fdigmblbr						
--.	.5529311	.1753758	3.15	0.002	.209201	.8966613
L1.	-.7599815	.3146355	-2.42	0.016	-1.376656	-.1433073
exrgmblbr	1.958696	.5666824	3.46	0.001	.8480188	3.069373
_cons	-.9143976	.261374	-3.50	0.000	-1.426681	-.4021141
bsgmbnga						
bsgmbnga						
L1.	-.1374679	.1405522	-0.98	0.328	-.4129452	.1380093
tfgmbnga						
--.	-.7696145	.1816802	-4.24	0.000	-1.125701	-.4135278
L1.	-.3595493	.2318476	-1.55	0.121	-.8139622	.0948637
mpgmbnga	-.3481746	.1478536	-2.35	0.019	-.6379624	-.0583869
fpgmbnga						
--.	.1929022	.1446637	1.33	0.182	-.0906334	.4764377
L1.	.5784624	.1514954	3.82	0.000	.281537	.8753879

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rsvgmbnga	-.3039347	.1283515	-2.37	0.018	-.5554991	-.0523703
fdigmbnga	.0043565	.1478884	0.03	0.976	-.2854994	.2942124
exrgmbnga	-.0142491	.2315	-0.06	0.951	-.4679809	.4394826
_cons	.2688063	.2342449	1.15	0.251	-.1903054	.7279179
bsgmbsle						
bsgmbsle						
L1.	-.0178059	.1660575	-0.11	0.915	-.3432725	.3076608
tfgmbsle	.3757575	.1555362	2.42	0.016	.0709122	.6806028
mpgmbsle	-.221346	.1492747	-1.48	0.138	-.5139189	.071227
fpgmbsle	.0465671	.1514305	0.31	0.758	-.2502313	.3433654
rsvgmbsle	-.2058796	.1506379	-1.37	0.172	-.5011244	.0893652
fdigmbsle						
--.	.3555527	.1589687	2.24	0.025	.0439798	.6671257
L1.	-.7139455	.2120118	-3.37	0.001	-1.129481	-.2984099
exrgmbsle	.1536786	.2506081	0.61	0.540	-.3375042	.6448615
_cons	-.091647	.2159697	-0.42	0.671	-.5149399	.3316458
bslbrnga						
bslbrnga						
L1.	.6408027	.2325842	2.76	0.006	.1849461	1.096659
tflbrnga						
--.	.2430562	.1483921	1.64	0.101	-.047787	.5338993
L1.	-.8165623	.1371766	-5.95	0.000	-1.085424	-.547701
mplbrnga	-.609718	.1578069	-3.86	0.000	-.9190139	-.3004221
fplbrnga						
--.	-1.499846	.3434674	-4.37	0.000	-2.17303	-.8266623
L1.	-.6482174	.1909812	-3.39	0.001	-1.022534	-.2739011
rsvlbrnga						
--.	-.4317811	.1478571	-2.92	0.003	-.7215758	-.1419865
L1.	-1.443983	.2652268	-5.44	0.000	-1.963818	-.9241485
fdilbrnga						
--.	1.00078	.2806013	3.57	0.000	.4508115	1.550748
L1.	.9607262	.2128221	4.51	0.000	.5436026	1.37785
exrlbrnga						
--.	.0105647	.2288675	0.05	0.963	-.4380074	.4591368
L1.	.4373286	.1276309	3.43	0.001	.1871766	.6874806
_cons	.3864324	.1377278	2.81	0.005	.1164909	.6563739
bslbrsle						
bslbrsle						
L1.	-.0931522	.2291509	-0.41	0.684	-.5422797	.3559753
tflbrsle	-.63959	.1548029	-4.13	0.000	-.942998	-.336182
mplbrsle	-.1368979	.2011996	-0.68	0.496	-.5312419	.257446
fplbrsle						
--.	.4801901	.2163894	2.22	0.026	.0560747	.9043054
L1.	.8599764	.2376817	3.62	0.000	.3941289	1.325824
rsvlbrsle	.70832	.1726281	4.10	0.000	.3699751	1.046665
fdilbrsle	-1.178106	.2471986	-4.77	0.000	-1.662606	-.6936052
exrlbrsle						
--.	-.6273398	.2895682	-2.17	0.030	-1.194883	-.0597966

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```
         L1. |  -.9415073   .2962178    -3.18   0.001    -1.522084   -.3609311
             |
       _cons |   1.262656   .4084544     3.09   0.002        .4621    2.063212
-------------+----------------------------------------------------------------
bsngasle     |
    bsngasle |
         L1. |   .4194628   .1024005     4.10   0.000     .2187615    .6201642
             |
    tfngasle |
         --. |  -.6370501   .0895359    -7.12   0.000    -.8125372   -.4615629
         L1. |  -.2633971   .0770895    -3.42   0.001    -.4144898   -.1123044
             |
    mpngasle |
         --. |   .3587315    .048403     7.41   0.000     .2638634    .4535996
         L1. |   .4075128   .0562729     7.24   0.000       .29722    .5178057
             |
    fpngasle |  -.4760793   .0787091    -6.05   0.000    -.6303463   -.3218123
             |
   rsvngasle |
         --. |  -.2043337   .1219792    -1.68   0.094    -.4434085    .0347412
         L1. |  -.5607395   .1134003    -4.94   0.000        -.783   -.3384789
             |
   fdingasle |  -.1144237   .0728347    -1.57   0.116     -.257177    .0283297
             |
   exrngasle |
         --. |  -.0805951   .0741813    -1.09   0.277    -.2259878    .0647976
         L1. |   .3252526    .071294     4.56   0.000      .185519    .4649863
             |
       _cons |   .4618421    .138039     3.35   0.001     .1912905    .7323936
------------------------------------------------------------------------------
```

The SURE analysis on the effects of the level of symmetry in external reserves, foreign direct investment inflows and index of exchange rate on the level of synchronization of business cycles between pairs of countries within WAMZ were mixed. Notwithstanding, Nigeria, Ghana and Guinea proved to be most similar compared to other pairs of countries under WAMZ.

4.4 Interpretation of the Breusch-Pagan test of independence for WAMZ

The Breusch-Pagan test examines the correlation between residuals from the fifteen (15) sets of simultaneous equations under WAMZ. As depicted in table 8, the test suggests that with a probability value of Chi-squared of 0.54 the residuals from the 15 equations are not significantly correlated at five per cent level.

Table 1: Breusch-Pagan test of independence for WAMZ

Chi-squared (105)	102.75
Prob. Value	0.54

Note: *= 1 percent level of significance, **= 5 percent level of significance

Source: Author's computation

Notwithstanding, the correlation matrix of residuals reveals that six (6) of the correlation coefficients are statistically significant at 5 per cent level which makes the SURE estimates to be more efficient than the individual OLS estimates.

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4.5 Interpretation of the Wald test for WAMZ

Table 2: Wald test for WAMZ

Chi-squared (84)	1942.11
Prob. Value	0.00

Note: *= 1 percent level of significance, **= 5 percent level of significance

Source: Author's computation

The Wald test of equality of regression coefficients also known as the test of coefficient restriction shows that the probability value of chi-squared is 0.00, indicating that the hypothesis that regression coefficients on the level of symmetry in trade flows, monetary policy, fiscal policy, external reserves, foreign direct investment inflows as well as the coefficient of the level of symmetry in real exchange rate index across all the 15 WAMZ equations are equal is rejected. This implies that the impact of the levels of symmetry in trade flows, the level of symmetry in monetary policy, fiscal policy, external reserve, foreign direct investments inflows as well as real exchange rates index on the level of synchronization of business cycles in each of the equations under WAMZ are significantly different.

4.6 Interpretation of the system residual portmanteau tests for autocorrelations for WAMZ

Table 3: System residual portmanteau tests for autocorrelations for WAMZ

Lags	Q-Stat	Prob.	Adj Q-Stat	Prob.
1	223.43*	0.52	237.39*	0.27
2	433.08*	0.71	474.99*	0.20
3	624.79*	0.92	707.79*	0.19
4	802.98*	0.99	940.80*	0.17
5	963.37*	1.00	1168.03*	0.18
6	1114.18*	1.00	1401.10*	0.16
7	1248.09*	1.00	1628.74*	0.17
8	1367.16*	1.00	1853.64*	0.19
9	1478.62*	1.00	2090.51*	0.15
10	1578.52*	1.00	2333.12*	0.11

Note: *= 1 percent level of significance, **= 5 percent level of significance

Source: Author's computation

The system residual portmanteau tests for autocorrelations of table 10 reveals that all the probability values for both the Q-statistic as well as the adjusted Q-statistic are greater than 0.01 which indicates that there is no autocorrelation in the 15 equations under WAMZ at one per cent level of significance

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5. CONCLUSION AND POLICY RECOMMENDATIONS

5.1 Conclusion

This work provides an answer on the feasibility of creating a second West African monetary union. The circumstance on which WAEMU was founded via colonization has made it heavily dependent on the conditionality of its founding father, France. The case of WAMZ on the contrary can never be the same because their decisions to thrive must solely be based on their perceptions, observations, investigations, findings and thus, the relevance of this this research. There is a clear-cut indication that most countries within WAMZ are still far from being merged to form a monetary union. The few with the level of symmetry in trade flows, monetary and fiscal policies that could eventually synchronize regional business cycles comprise of Ghana, Nigeria and Guinea. In the case of Ghana and Nigeria as well as Guinea and Nigeria, the level of symmetry in their index of exchange rate does not seem to synchronize their business cycles. As a result, there must be a strong exchange rate alignment in the course of pegging the Ghanaian cedi and Nigerian naira as well as Guinean franc and Nigerian naira to the wamz-eco. The cyclical thrift scheme would offer an enabling environment for improved level of industrialization to boost productions, employment as well as regional trade given the level of exchange rate alignment.

5.2 Policy Recommendations

From the findings the following policy recommendations are put forward:

i. Pairs of countries that are highly symmetric under WAMZ such as Nigeria, Ghana and Guinea should form the Second West African Monetary Union (SWAMU) by the year 2021 and create room for others readily available to eventually merge-up.

ii. The Nigerian naira, Ghanaian cedi and the Guinean franc should continue to thrive but multilaterally tied/pegged to a single currency the wamz-eco while paving ways for the individual currencies to eventually culminate.

iii. Trade barriers should to a large extent be relaxed and trade protection/restriction emphasized amongst countries within West Africa. Countries must trade intensely with each other excepts where the goods and services are lacking.

iv. Attention must be centered on domestic investment by compelling the various countries under WAMZ to plunge a certain percentage of internally generated revenue or from external reserves into the cyclical thrift scheme in order to boost industrialization within ECOWAS region. The remaining percentage from external reserves could be used to checkmate emerging distortions from inflation, unemployment, etc.

v. Discipline must be emphasized and penalty/sanctions imposed on defaulters especially in the usage of funds from the cyclical thrifts. This would boost industrialization and stimulate bilateral trade within West African region.

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